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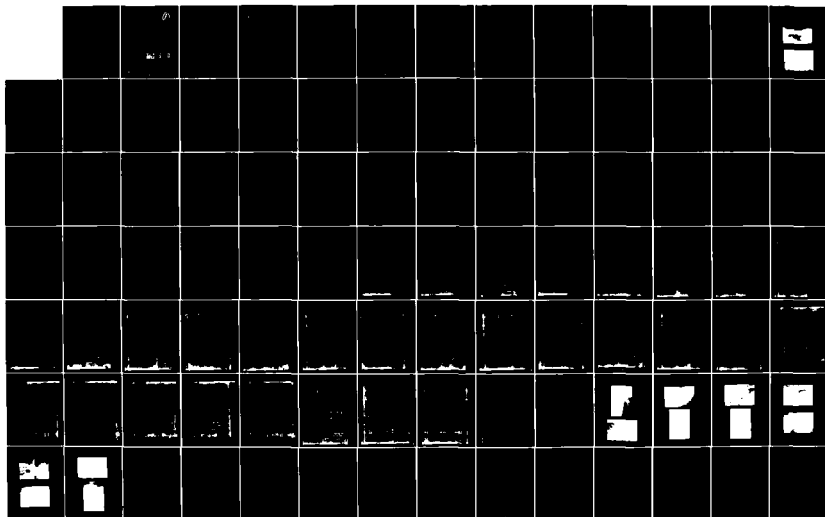
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PORTLAND RESERVOIR DA..(U) CORPS OF ENGINEERS WALTHAM
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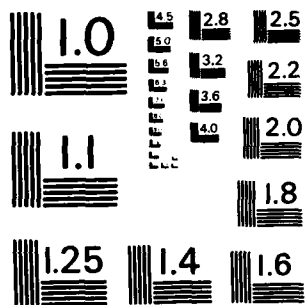
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CONNECTICUT RIVER BASIN
PORTLAND, CONNECTICUT



PORTLAND RESERVOIR DAM

CT 00149

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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DEPARTMENT OF THE ARMY
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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00149	2. GOVT ACCESSION NO. AD-A143346	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Portland Reservoir Dam		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE June 1979
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18. SUPPLEMENTARY NOTES Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Conn. River Basin Portland, Conn. Portland Reservoir Dam		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Portland Reservoir Dam is an earthfill dam with an impervious core, about 400 ft. long, with a maximum height of about 28 ft. A 450 ft. long earthfill embankment serves as a right abutment closure dike. The test flood inflow equals 9,350 cfs. The dam appears to be in good condition, but there is extensive erosion along the upstream face of the right abutment dike. Portland Reservoir is utilized as a water storage facility for the Town of Portland, Conn.		



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED

SEP 24 1979

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor Grasso:

I am forwarding to you a copy of the Portland Reservoir Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, Portland Water Works, Town Hall, Portland, Connecticut 06605, ATTN: Mr. Seiserman, Director of Public Works.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

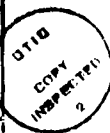
Sincerely,

Max B. Scheider
MAX B. SCHEIDER

Colonel, Corps of Engineers
Division Engineer

Incl
As stated

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PORTLAND RESERVOIR DAM

CT 00149

CONNECTICUT RIVER BASIN
PORTLAND, CONNECTICUT

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.: CT 00149
Name of Dam: Portland Reservoir Dam
Town: Portland
County and State: Middlesex County, Connecticut
Stream: Reservoir Brook
Date of Inspection: 24 April and 9 May 1979

BRIEF ASSESSMENT

Portland Reservoir Dam is an earthfill dam with an impervious core, about 400 ft. long, with a maximum height of about 28 ft. A 450 ft. long earthfill embankment serves as a right abutment closure dike. The spillway is a 94 ft. long ungated overflow ogee crest located about 300 ft. from the left abutment. A wet well and gate house just to the right of the spillway on the crest of the earth embankment houses the control valves for the inlet and outlet pipes. There are two inlet pipes (20 in. dia. and 12 in. dia. pipes with 20 in. and 12 in. gate valves, respectively) and three outlet pipes (20 in. dia. and two 8 in. dia. pipes with 20 in. and 8 in. gate valves). There is also a 16 in. dia. blowoff pipe that has an in-line valve controlled at the manhole just downslope of the gate house. A water treatment plant is situated at the downstream toe of the dam.

Portland Reservoir is utilized as a water storage facility for the Town of Portland, Connecticut. It is about 2,300 ft. long and has a surface area of 30.3 acres at spillway crest level. The drainage area is 3.52 sq. mi. (2,255 acres) and the maximum storage to top of dam is 510 acres; the size classification is thus small. Because a breach of the dam would affect about 16 homes and 3 local roadways, with the possibility of loss of more than a few lives and the probability of appreciable economic losses, it has been classified as having a high hazard potential. Based on small size and high hazard, the range for the test flood is $\frac{1}{2}$ PMF to PMF. The selected test flood is the full PMF.

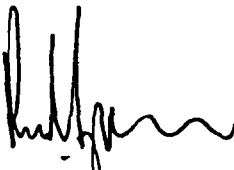
The spillway is capable of discharging 2,140 cfs at elevation 316.5 MSL, the low point of the right abutment closure dike. Surge capacity from the spillway crest, elevation 313.0 MSL to the low point of the right abutment closure dike, elevation 316.5 MSL, is only 3.5 ft.

The test flood inflow equals 9,350 cfs. The routed test flood outflow (8,450 cfs) overtops the dam by about 2.3 ft.. The spillway is adequate to pass about 25 percent of the routed test flood outflow without overtopping the dam.

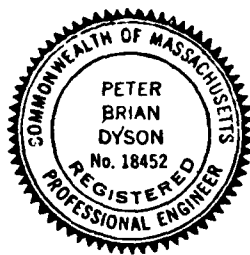
The dam appears to be in good condition, but there is extensive erosion along the upstream face of the right abutment dike. Brush growth has begun to intrude on the upstream face of the dike. Along the crest of the dam to the left of the spillway there are several mature trees.

Within one year after receipt of this Phase I Inspection Report, the owner, the Town of Portland, should retain the services of a competent registered professional engineer, and implement the results of his evaluation of the following: (1) whether the dam and dike embankment should be raised and leveled to the elevation of the spillway training walls; (2) whether an impervious blanket and a riprap facing should be provided on the upstream side of the dike; and (3) the source of leakage along the spillway's left downstream wingwall.


The owner should also implement the following operational and maintenance procedures: (1) restore riprap on the upstream face of the dike, particularly in the area to the right of the gate house; (2) redress the riprap located on the downstream side of the dam near the spillway outlet; (3) repair the spalled panel on the left side of the spillway chute; (4) clear growth from the embankment and in the channel immediately downstream of the spillway; (5) monitor flows from the left and right toe drains, and the collector outlet located about 200 ft. downstream of the dam; (6) restore heavily worn pathways on the embankment; (7) institute procedures for an annual periodic technical inspection of the dam and appurtenant works; and (8) establish a formal surveillance and flood warning plan.




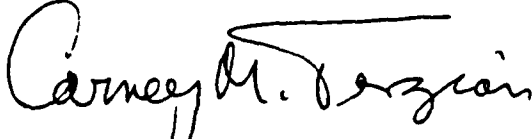
Peter B. Dyson
Project Manager



This Phase I Inspection Report on Portland Reservoir Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.


JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division


JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division


CARNEY M. TERZIAN, CHAIRMAN
Chief, Structural Section
Design Branch
Engineering Division

APPROVAL RECOMMENDED:


JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation: however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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APPENDIXES

APPENDIX A - INSPECTION CHECKLIST

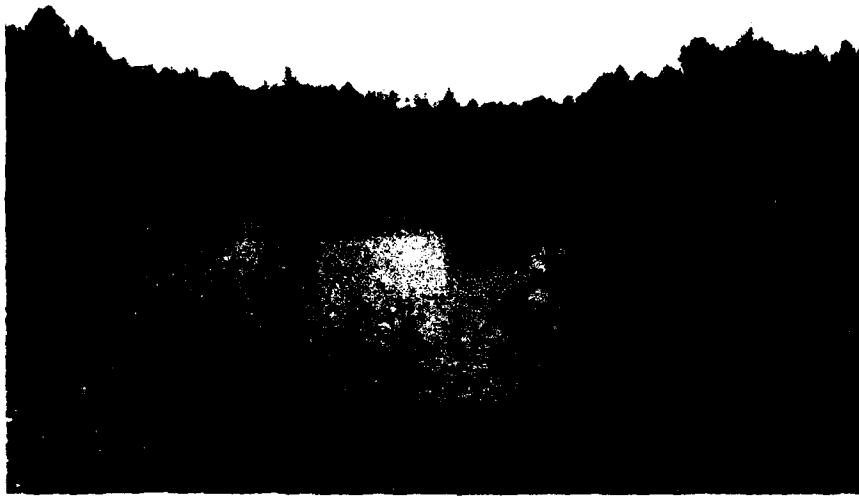
APPENDIX B - ENGINEERING DATA

APPENDIX C - PHOTOGRAPHS

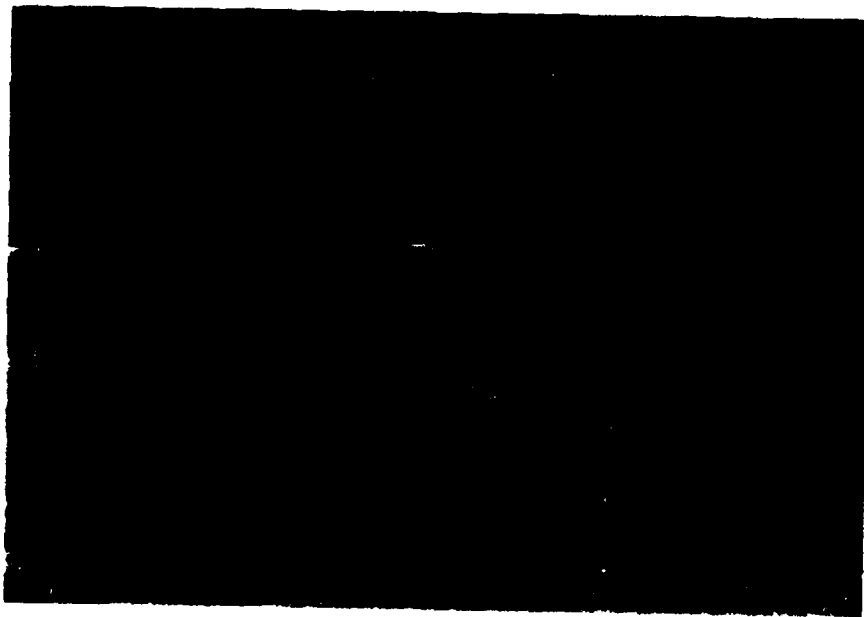
APPENDIX D - HYDROLOGIC AND HYDRAULIC COMPUTATIONS

APPENDIX E - INFORMATION AS CONTAINED IN THE NATIONAL
INVENTORY OF DAMS

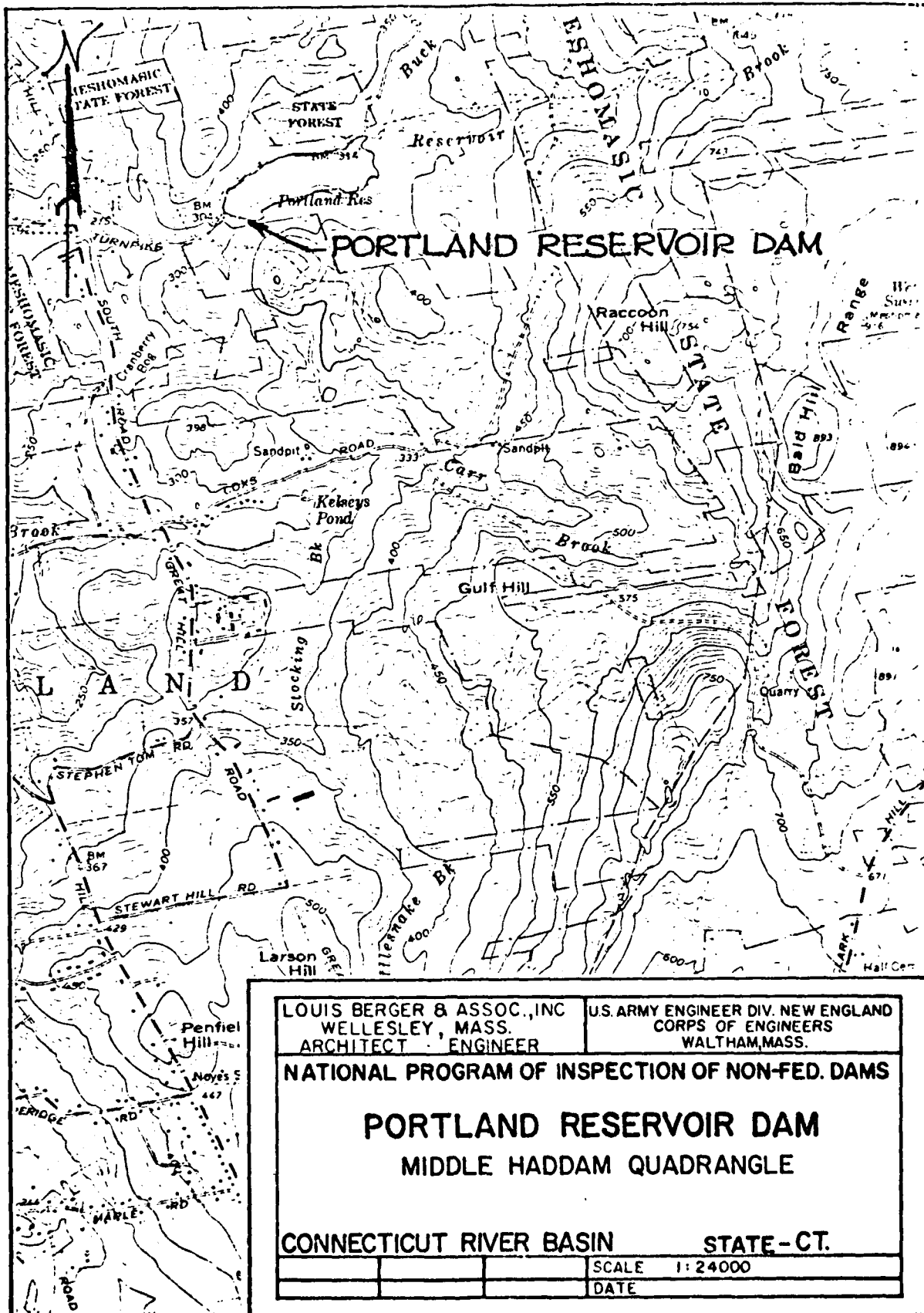
PORTLAND RESERVOIR DAM



Overview from Right Abutment



Overview from Left Abutment



PHASE I INSPECTION REPORT
PORTLAND RESERVOIR DAM CT 00149

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Louis Berger & Associates, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to Louis Berger & Associates, Inc. under a letter of 19 March 1979 from John P. Chandler, Colonel, Corps of Engineers. Contract No. DACW33-79-C-0051 has been assigned by the Corps of Engineers for this work.

b. Purpose.

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.

(3) Update, verify and complete the National Inventory of Dams.

1.2 Description of Project.

a. Location. Portland Reservoir Dam is located in the town of Portland, Middlesex County, Connecticut. The dam is reached via State Highways 17A, 17 and the Old Marlborough Turnpike. The reservoir and dam are situated near the headwaters of Reservoir Brook, a tributary of the Connecticut River. The normal storage level of the reservoir is 312.5 MSL, while the confluence of Reservoir Brook and the Connecticut River, about 2.7 miles below the dam, is about 10 MSL. The dam is shown on U.S.G.S., Quadrangle, Middle Haddam, Connecticut, with coordinates approximately at N41°36'53", W72°34'14".

b. Description of Dam and Appurtenances.

(1) Description of Dam. Portland Reservoir Dam is an earthfill structure about 28 ft. high and 400 ft. long. The dam is a reconstructed and raised structure built in 1963-64 over an existing dam, to increase the storage capacity of Portland Reservoir. The original dam had a crest elevation of about 304.5; the new dam has its crest at elevation 313.0 MSL.

The original dam was constructed of stone. Its upstream face was nearly vertical while the downstream face was stepped on about a 1 to 1 slope. The old dam was left in place when the new embankment was constructed, and it now forms the downstream toe of the new dam.

The new dam was built with its baseline at the upstream face of the existing dam. Steel sheet piling with a concrete cap was constructed about 18 ft. upstream of the baseline. Grout holes, 5 ft. on centers, were made 25 ft. deep into rock from Sta. 0+90 to Sta. 1+10 and from Sta. 2+35 to Sta. 2+60 (see Appendix B).

The embankment section consists of a core of impermeable material within shells of pervious material. The impermeable core is 10 ft. wide at the top with a 1 to 1 slope on both the upstream and downstream sides and is cut into the original ground by varying amounts. The crests of the pervious shells vary in width from 10 ft. on the right side of the spillway, to 34 ft. on the left side of the spillway. The upstream slope of the embankment is $2\frac{1}{2}$ horizontal to 1 vertical and the grass-covered downstream slope is 2 horizontal to 1 vertical. The upper portions of the upstream slopes are riprapped on both sides of the spillway, as are the downstream toes in the vicinity of the spillway. No other riprap is present. Toe drains are located along the embankment on both sides of the spillway.

A 450 ft. long earthfill closure dike serves as the right abutment of the dam. The closure dike is situated essentially perpendicular to the dam. The crest width is about 15 ft. The upstream slope is $2\frac{1}{2}$:1 and the grass-covered downstream slope is 3:1. There is no longer any riprap on the upstream slope.

(2) Spillway. The spillway for Portland Reservoir is located about 300 ft. to the right of the left abutment. The spillway is a 94 ft. long ungated ogee crest built over the original masonry dam. The upstream slope is vertical up to elevation 309.0 MSL. From there to the crest of the spillway, elevation 313.0 MSL, the upstream slope is 1:1. The average downstream slope is about 2:1. The top of the spillway training walls is at elevation 319.5 MSL.

The channel downstream from the crest consists of a 28 ft. long energy dissipating stilling basin with 25 sawtoothed baffle blocks and a terminal wall. The entire structure is constructed of concrete. At the center of the ogee, 12 ft. of the crest are depressed 6 in. Popcorn drains are located beneath the structure at both the upstream and downstream toes. The popcorn drains are connected to cast iron draw pipes which lead to a manhole. A 16 in. dia. pipe outlets from the manhole into Reservoir Brook.

(3) Outlets. Two inlet pipes to the wet well and gate house are provided at selected levels for releasing stored waters from the reservoir. A 20 in. dia. inlet pipe (El. 300.0 MSL) and a 12 in. dia. inlet pipe (El. 295.0 MSL) lead from the upstream face of the spillway to the wet well and gate house where they are controlled by 20 in. and 12 in. gate valves, respectively. From the wet well and gate house a 20 in. dia. outlet pipe and two 8 in. dia. outlet pipes (with 20 in. and 8 in. gate valves) lead to the treatment facility located just downstream of the dam. A 16 in. dia. blowoff pipe, at about elevation 290 MSL, leads from the upstream toe of the spillway to a manhole located on the downstream slope of the embankment just below the gate house. There a 16 in. in-line valve controls flows to the downstream channel.

c. Size Classification. Portland Reservoir Dam is about 28 ft. high impounding a storage of 375 acre-ft. to spillway crest and about 510 acre-ft. to top of dam. In accordance with size and capacity criteria promulgated in the Recommended Guidelines for Safety Inspection of Dams, the project is categorized in the small classification.

d. Hazard Classification. A breach failure of the dam at Portland Reservoir would release water down Reservoir Brook to the Connecticut River. In the reaches below the dam, the discharge channel first parallels the south side of Old Marlborough Turnpike for about 2,500 ft. before crossing under the Turnpike. It is estimated that a breach of the dam would cause a flood stage of about 14.5 ft. at this location, thereby flooding Old Marlborough Turnpike, Cotton Hill Road and two adjacent dwellings. Reservoir Brook parallels the north side of Old Marlborough Turnpike in the next reach and would flood about 3 dwellings. At about 4,500 ft. downstream from the dam, the flood stage drops rapidly to about 8.5 ft. because of a wider flood plain. However, this stage is high enough to cause damage to a small subdivision of homes located near the intersection of Old Marlborough Turnpike and Thompson Hill Road. As many as 11 homes could be affected in this area. The brook then crosses under Thompson Hill Road and some flooding of this intersection can be expected. Only minor flooding is anticipated downstream from this point. A total of 16 dwellings and three local roads would be expected to suffer serious damage, with the loss of more than a few lives. Consequently, Portland Reservoir Dam has been classified as having a high hazard potential, in accordance with the Recommended Guidelines for Safety Inspection of Dams.

e. Ownership. Portland Reservoir Dam is owned by the Portland Water Works, Town Hall, Portland, Connecticut.

f. Operator. Mr. Joseph Seiserman, Director of Public Works, Town of Portland, Town Hall, Portland, Connecticut. Telephone: (203) 342-2880.

g. Purpose of Dam. Portland Reservoir Dam is operated in conjunction with other water storage facilities, for providing municipal water supplies to the Town of Portland.

h. Design and Construction History. No documentation on design or construction has been recovered for the original dam and it is not known when it was built. The dam was raised and reconstructed in 1963-64 to increase water storage capacity for the Town of Portland. The reconstructed dam was designed by Argraves Engineers. Construction plans and a limited amount of hydraulic design data were recovered (see Appendix B).

i. Normal Operating Procedure. No written operating procedures were disclosed. The treatment plant for the facility is located just downstream of the dam and operators visit the site on a daily basis.

1.3 Pertinent Data.

a. Drainage Area. The drainage area contributing to Portland Reservoir Dam is situated near the headwaters of Reservoir Brook. The drainage area encompasses a total of about 3.52 sq. mi. (2,255 acres), of which about 30 acres are occupied by the reservoir. The longest circuitous stream course contributing to the lake is about 14,000 ft. long with an elevation difference of about 417 ft., or a slope of about 157 ft. per mile. The drainage area has a length of about 2.3 miles and a maximum width of about 2.5 miles. The basin is nearly all forested, containing only two open fields, and is sparsely populated, and is best described as hilly to mountainous terrain.

b. Discharge at Damsite.

(1) Outlet Works Conduit. Release of stored water from Portland Reservoir Dam is provided by a 20 in. dia. pipe and a 12 in. dia. pipe to the wet well and gate house, from which there are a 20 in. dia. and two 8 in. dia. outlet pipes to the treatment facility. A 16 in. dia. blowoff pipe, which is controlled by a 16 in. valve, located in a manhole just below the gate house is also provided and discharges into Reservoir Brook. The capacity of the blowoff pipe is approximately 25 cfs with the water surface at the test flood elevation and about 24 cfs with water surface at the top of dam. The inlet invert of the blowoff pipe is at about elevation 290.

(2) Maximum Known Flood at Damsite. No records are available of flood flows into Portland Reservoir, nor of spillway releases and surcharge heads during such inflows. The highest known head above the spillway crest recalled by Town personnel was about 1.33 ft., which would yield a discharge of about 500 cfs over the spillway.

(3) Ungated Spillway Capacity at Top of Dam. The spillway at the reservoir is an ungated concrete, ogee spillway. The total spillway capacity at top of dam, elevation 316.5 MSL, is 2,140 cfs.

(4) Ungated Spillway Capacity at Test Flood Elevation. The ungated spillway capacity is about 4,750 cfs at test flood elevation 318.8 MSL.

(5) Gated Spillway Capacity at Normal Pool Elevation. Not applicable

(6) Gated Spillway Capacity at Test Flood Elevation. Not applicable

(7) Total Spillway Capacity at Test Flood Elevation. The total spillway capacity at the test flood elevation is the same as (4) above, 4,750 cfs at elevation 318.8 MSL.

(8) Total Project Discharge at Test Flood Elevation. The spillway is inadequate to handle the test flood and the dam would be overtopped by about 2.3 ft. at elevation 318.8 MSL. The total discharge through the spillway and over the top of the dam would be about 8,450 cfs.

c. Elevations (Ft. above MSL).

(1) Streambed at centerline of dam - 288.5

(2) Maximum tailwater - Not available

(3) Upstream invert of outlet culvert - 290.0 \pm

(4) Recreation Pool - Not applicable

(5) Full flood control pool - Not applicable

(6) Ungated spillway crest - 312.5

(7) Design surcharge (original design) - Unknown

(8) Top of dam - Varies from 316.5 (low point of right abutment closure dike) to 319.5 (top of spillway training walls)

(9) Test flood design surcharge - 318.8

d. Reservoir

- (1) Length of maximum pool - 2,300 ft.
- (2) Length of recreation pool - Not applicable
- (3) Length of flood control pool - Not applicable

e. Storage (acre-ft.)

- (1) Recreation pool - Not applicable
- (2) Flood control pool - Not applicable
- (3) Spillway crest pool El. 312.5 - 375
- (4) Top of dam El. 316.5 - 510
- (5) Test flood pool El. 318.8 - 610

f. Reservoir Surface (acres)

- (1) Recreation pool - Not applicable
- (2) Flood control pool - Not applicable
- (3) Spillway crest El. 312.5 - 30.3
- (4) Top of dam El. 316.5 - 40.0
- (5) Test flood pool El. 318.8 - 48.0

g. Dam

- (1) Type - Dam: Earthfill with impervious core
Dike: Earthfill
- (2) Length - Dam: 400 ft., Dike: 450 ft.
- (3) Height - Dam: 28 ft., Dike: varies from 0 to 28 ft.
- (4) Top width - Varies from 10 ft. to 34 ft.
- (5) Side slopes - Upstream $2\frac{1}{2}$ horizontal to 1 vertical
Downstream 2 horizontal to 1 vertical
- (6) Zoning - Unknown impervious core, with pervious shell
- (7) Impervious core - Unknown impervious material
- (8) Cutoff - Partial masonry wall
- (9) Grout curtain - Unknown (some grout holes on plans)

h. Diversion and Regulating Tunnel - None

i. Spillway

- (1) Type - Concrete ogee
- (2) Length of weir - 94 ft.
- (3) Crest elevation - 312.5 at 12 ft. wide notch, remainder 313.0
- (4) Gates - None
- (5) Upstream channel - None
- (6) Downstream channel - Stilling basin with concrete stilling blocks and energy dissipating wall discharging into a natural channel.

j. Regulating Outlets

- (1) Inverts - 16 in. dia. blowoff - 290+
 - 12 in. dia. - 295
 - 20 in. dia. - 300
- (2) Size - 12 in. dia. and 20 in. dia. inlet pipes to wet well, 20 in. dia. and two 8 in. dia. outlet pipes to treatment facility
 - 16 in. dia. blowoff pipe
- (3) Description - Cast iron pipes
- (4) Control Mechanism - Gate valves in wet well at gate house with control hoist. All gate valves are the same size as the pipes they control.
- (5) Other - 16 in. dia. blowoff pipe regulated by 16 in. in-line gate valve.

SECTION 2 - ENGINEERING DATA

2.1 Design Data

No data on the design of the original dam has been found. The 1963-64 reconstruction of the dam was designed by Argraves Engineers. Copies of design drawings are included in Appendix B.

2.2 Construction Data

No information relating to construction of the original dam has been found and probably none exists. The reconstructed dam was completed in 1964 under the supervision of the design engineers, Argraves Engineers. The firm of John J. Mozzochi and Associates, inspected the work on behalf of the State Water Resources Commission. A certificate of approval for the work was issued on November 19, 1964. The limited amount of correspondence located relative to construction is included in Appendix B.

2.3 Operation Data

No specific operation data or operation and maintenance manuals have been issued, either by the design engineers or the operating agency. There appear to be no formal operating records.

2.4 Evaluation

a. Availability. The reconstruction plans, correspondence concerning construction of the dam and appurtenances, previous inspection reports and the visual observations of the inspection team form the basis for the information presented in this report.

b. Adequacy. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgment.

c. Validity. The validity of the engineering data acquired covering the dam is considered acceptable and is not challenged.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General. The visual inspection of Portland Reservoir Dam took place on 24 April and 9 May 1979. On both days the reservoir was about 2 in. above the low center section of the spillway crest. The dam was judged to be in generally good condition, but a few items require attention (see Sections 7.2 and 7.3).

b. Dam. The dam is an earthfill embankment about 400 ft. long with a 94 ft. wide concrete ogee spillway section. A 450 ft. long earthfill embankment serves as a right abutment closure dike. The dam is a reconstructed and raised structure built in 1963-64 over an existing dam (see Photo Nos. 1-5, Appendix C). The dam has an ogee spillway with a 6 in. deep, 12 ft. wide recessed center section. A wet well and gate house is located on the crest of the dam immediately to the right of the spillway. According to the licensing plans and borings, the dam is founded on "hardpan" about 8 ft. above bedrock.

The profile of the crest of the right abutment closure dike is not horizontal. There is about a 2 ft. difference in elevation between the gate house and a point about 450 ft. to the right of the gate house; elevation 318.5 versus elevation 316.5 respectively. The top of the embankment is about 10 ft. wide. Extensive erosion of this gravel embankment has occurred on the upstream slope, which is not protected with riprap. The upstream slope was also covered with brush and saplings.

At the toe of the spillway's right wingwall, two drains flowing at about 0.5 gpm each were discharging onto the randomly placed riprap at the end of the energy dissipator. The upper drain is for surface drainage from a catch basin on the access road, and the lower serves the right toe drain. The riprap in this area had become displaced, voids had appeared, and loss of ground was evident (see Photo No. 7, Appendix C).

Approximately 200 ft. downstream of the spillway's energy dissipator, another drain issues from the right bank of the downstream channel. On plan it appears to serve the "pop-corn" drains at the toe of the new ogee section, and beneath the spillway apron. The discharge approached 1.0 to 2.0 gpm, some of it from seepage around the pipe.

There has been considerable slope erosion at the toe of the left wingwall to the extent that the dislodged riprap cannot check the deterioration of the slope. Just below the end of the left wingwall the toe drain outlet, largely obscured by the irregular riprap, discharged at about 0.1 gpm. The flow was clear, with no suspended fines (see Photo No. 6, Appendix C).

The left embankment was heavily overgrown with mature conifers. The crest of the dam itself is of gravelly sand and there had been no attempt at planting or of soil protection. The left upstream slope, as on the right closure dike, was becoming heavily invaded with young brush and saplings. Some few feet beyond the limits of the left abutment, rock outcrops were noted (see Photo No. 8, Appendix C).

c. Appurtenant Structures. The spillway is located at the center of the dam and consists of a 94 ft. long ogee crested weir. While the ogee section, apron, and energy dissipator all appeared to be in fair condition, a rather severe but localized concrete spalling at the bottom of the spillway's top left panel was apparent. Also, where the left wingwall joins the abutment wall, there was a leak at the bottom of the joint. The leak was slight but persistent and obviously of long duration. This seep had badly discolored the concrete and has caused its deterioration (see Photo Nos. 9-12, Appendix C).

The brick gate house and wet well with trash racks appeared to be in fair condition with some minor deterioration of the brick. All control gates were reported to be operative, as was the blowoff valve.

d. Reservoir Area. The shoreline around the reservoir is wooded and appeared stable with evidences of frequent outcrops of bedrock. An inspection of the road embankment to the north of the reservoir was made to examine the relative heights of the roadway and the reservoir proper. In this area the roadway is very low-lying and has in the past been frequently overtopped. A culvert has been installed under the roadway, essentially to act as an equalizer between the reservoir and the marshy, poorly drained lagoon to the north of it. There are no homes or other structures on the shoreline of the reservoir.

e. Downstream Channel. Immediately below the stilling basin, the channel is becoming overgrown with trees, some mature, but most saplings. The channel parallels the south side of Old Marlborough Turnpike. There are no homes in close proximity to the stream until the brook crosses under Old Marlborough Turnpike about 2,500 ft. below the dam. Two houses could be affected by high water. Shortly beyond this point the brook crosses under Cotton Hill Road and then parallels Old Marlborough Turnpike to the north. A few homes located in this reach of the brook could also be affected by high water. About 4,500 ft. downstream of the dam the stream passes near a small housing development before crossing under Thompson Hill Road. Houses in this area could be affected by unusually high water. At about 2.7 miles below the dam Reservoir Brook joins the Connecticut River.

3.2 Evaluation

In general the visual inspection of the dam adequately revealed key characteristics of the project as they may relate to its stability and integrity, permitting an assessment to be made of those features affecting the safety of the structure. The dam and appurtenant structures appear to be in generally good condition, except for the right abutment closure dike which is only in fair condition.

The irregular profile of the dam and right abutment closure dike prevent the entire discharging capacity of the spillway to be utilized; the right abutment closure dike is overtopped at elevation 316.5 MSL while the top of the spillway training wall is at elevation 319.5 MSL.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

The Portland Reservoir facility is operated by personnel of the Portland Water Works Department, who daily visit the treatment plant about 100 ft. below the dam. Reservoir operation entails mainly the release of stored water from the reservoir as water supply needs warrant. The outlets from the reservoir to the treatment plant are pressure pipes, with valves at the outlet of the pipes such that day-to-day regulation of the outlet valves are not required. No documented operating procedures have been prepared.

4.2 Maintenance of Dam

Little maintenance of the dam is required except for periodic cutting of brush and trees and maintaining the riprap in good condition. No documented maintenance instructions have been prepared.

4.3 Maintenance of Operating Facilities

No specific maintenance program is in effect. It is presumed that some maintenance to the gates and valves controlling the intake pipes has been performed in the past to keep the mechanisms operative.

4.4 Description of any Warning System in Effect

No warning system is in effect at Portland Reservoir Dam.

4.5 Evaluation

The Portland Reservoir Dam is of recent construction with simple operating devices for regulating flows from the reservoir. Maintenance involves periodic growth removal from the embankment, surveillance regarding seeps, slope damage, animal burrows, etc., and maintenance of the riprap slope protection. A formal warning system should be developed.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General. Portland Reservoir Dam is an earthfill embankment, impounding a normal storage of about 375 acre-ft., with provision for an additional 135 acre-ft. of capacity in its surcharge space to the top of the dam. The dam and reservoir are maintained by the Town of Portland for water supply purposes. The 94 ft. wide concrete ogee spillway has a 12 ft. wide notch at elevation 312.5 MSL. The main spillway crest, at elevation 313.0 MSL, is capable of discharging about 2,140 cfs with surcharge to elevation 316.5 MSL. At this elevation water begins to overtop a low point in the right abutment closure dike. The topographic characteristics of the 3.52 sq. mi. (2,255 acre) drainage basin can best be described as hilly to mountainous terrain and heavily forested, with elevations ranging from 313 MSL at the spillway crest to about elevation 916 MSL.

b. Design Data. There is a limited amount of design data available for the dam (see Appendix B).

c. Experience Data. No records are available regarding past operation, surcharge encroachments, or flows through the spillway. The maximum past inflows are unknown. The highest observed flow over the main spillway crest was 1 ft. 4 in., which would yield a discharge of about 500 cfs.

d. Visual Observations. There are no present evidences either along the reservoir or in the downstream channel to indicate extreme high water levels or signs of any major spillway outflows. No one contacted could recollect any such occurrences.

e. Test Flood Analysis. Reservoir area and capacity curves and tables, for use in flood routings, are shown on Sheet D-1 and Figure 1, Sheet D-2, Appendix D. For determining surface areas and surcharge capacities, planimetered areas were taken from contours delineated on USGS 2,000 ft. per in. quadrangle sheets and from plans received from the State of Connecticut DEP.

The test flood chosen to evaluate the hydrologic and hydraulic capacity of Portland Reservoir Dam was selected in accordance with the criteria presented in the Recommended Guidelines for Safety Inspection of Dams. Since this dam is classified as small in size with a high hazard potential, the range for the test flood is $\frac{1}{2}$ PMF to PMF. Because of the possibility of extensive damage downstream of the reservoir the full PMF was selected for the evaluation.

Precipitation data was obtained from Hydrometeorological Report No. 33, which for the Connecticut area approximates 24.0 in. of 6 hour point rainfall over a 10 sq. mile area. This value was then reduced by 20 percent to allow for basin size, shape and fit factors. The 6 hour rainfall was distributed into one hour incremental periods as suggested in COE Publication EC 1110-2-1411.

A triangular incremental unitgraph was assumed for the inflow hydrographs, using a computed lag time value of 2.2 hours to derive a time-to-peak for the triangular hydrograph of 2.2 hours (see computations on Sheets D-3 thru D-7, Appendix D).

A test flood inflow hydrograph is shown on Fig. 2, Sheet D-7. Appendix D, indicating a peak inflow of about 9,350 cfs or a CSM of about 2,660.

Discharge tables and curves for the spillway and for over the top of the dam are shown on Sheets D-8 thru D-12 and Fig. 3, Sheet D-13, Appendix D. The spillway capacity at the low point of the right abutment dike, elevation 316.5 MSL, is 2,140 cfs.

Flood routings were performed for both 1/2 and full PMF. Results of these routings are shown on Sheets D-14, D-15 and D-16 and are summarized as follows:

Flood Magnitude	Max. Routed Outflow cfs	Max. Res. El. ft. MSL	Max. Head Over Dam ft.
1/2 PMF	3,950	317.6	1.1
PMF (Test Flood)	8,450	318.8	2.3

From the above table, it can be seen that the project will not pass the routed test flood outflow without overtopping the dam by 2.3 ft. The project, however, can handle 25 percent of the routed test flood outflow without overtopping the dam.

Drawdown of the reservoir is possible through the 16 in. dia. blow-off pipe.

f. Failure Analysis. As discussed above, the dam would be overtopped by the routed test flood outflow. Also, a breach owing to structural failure of the dam by piping or sloughing is a possibility. A breach from overtopping was assumed with the water level at the top of dam, elevation 316.5, the lowest part of the right abutment closure dike. The "rule of thumb" criteria suggested in the NED March 1978 Guidance Report was used for the breach analysis. With a breach width of 40 percent of the dam length at mid-height or about 125 ft., an outflow of about 31,000 cfs would be realized (see Sheets D-17 thru D-21, Appendix D).

In the reaches below the dam, the outflow would first cross the Old Marlborough Turnpike, between the Turnpike's intersection with South Road and Cotton Hill Road, approximately 2,500 ft. downstream from the Dam. The flood stage at this point is about 14.5 ft., which is about 9.0 ft. higher than the brook's stage just prior to failure of the dam, and would inundate the roadway intersections and two adjacent dwellings on Cotton Hill Road. As the stream continues, paralleling the Old Marlborough Turnpike to the north, several additional dwellings would also become flooded.

At approximately 4,500 ft. downstream from the dam, the flood stage drops rapidly to about 8.5 ft., due to a widening of the stream bed. This stage is about 6 ft. higher than the brook's stage just prior to failure, high enough to cause significant damage to a small subdivision of homes located north of the stream off Thompson Hill Road.

Reservoir Brook then crosses under Thompson Hill Road and several homes immediately adjacent to the intersection of Thompson Hill Road and Old Marlborough Turnpike would also be affected. Though some flooding of this intersection can be expected, only minor flooding from this point downstream is anticipated.

In summary, a total of 16 dwellings and three roadway crossings would suffer significant damage, should a breach of this type occur (see Figure 5, Sheet D-22, Appendix D).

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation. The field investigations of the embankment revealed no significant displacement or distress which would warrant the preparation of slope stability computations based on assumed soil properties and engineering factors.

The dam appears to be in good condition, but deficiencies described under Section 7 should be corrected.

b. Design and Construction Data. No design or construction data regarding the original masonry dam was recovered. Plans for the 1963-64 reconstruction of the dam, prepared by Argraves Engineers, were reviewed. No plans or calculations of value to a stability assessment are available.

c. Operating Records. Operating records are maintained by Portland's Water Department. There are no operating records of any significance to structural stability.

d. Post-Construction Changes. No post-construction changes are known which would adversely affect the stability or integrity of the dam.

e. Seismic Stability. The dam is located in Seismic Zone No. 1, and in accordance with Phase I guidelines, does not warrant seismic analysis.

SECTION 7
ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. On the basis of the Phase I visual examination, Portland Reservoir Dam appears to be in good condition. The deficiencies revealed indicate that further investigations are required; the principal items of concern are the structural integrity of the right abutment closure dike and the seepage along the spillway's left downstream wingwall.

b. Adequacy of Information. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgment.

c. Urgency. The recommendations and remedial measures enumerated below should be implemented by the owner within one year after receipt of this Phase I Inspection Report.

d. Need for Additional Investigations. Additional investigations are required as recommended in Para. 7.2.

7.2 Recommendations

It is recommended that the Town of Portland should retain the services of a competent registered professional engineer to make further investigations of the following, and should implement the results of his studies regarding:

- (1) Whether the dam and dike embankment should be raised and leveled to the elevation of the spillway training walls.
- (2) Whether an impervious blanket and riprap facing should be provided on the upstream face of the right abutment closure dike.
- (3) The source of leakage at the joint between the spillway's left downstream wingwall and the left abutment.

7.3 Remedial Measures

a. Operation and Maintenance Procedures

- (1) Restore and redress riprap on the upstream face of the dike, particularly in the area to the right of the gate house.
- (2) Redress riprap located on the downstream side of the dam near the outlet of the spillway.
- (3) Repair the spalled panel on the left side of the downstream face of the spillway crest.

- (4) Clear growth from the dam embankment on both sides of the spillway, and in the channel immediately below the spillway.
- (5) Monitor flows from the left and right toe drains, and the collector drain outlet located about 200 ft. downstream of the dam.
- (6) Restore heavily worn pathways on the embankment.
- (7) Procedures for an annual periodic technical inspection of the dam and appurtenant works should be instituted.
- (8) A formal surveillance and flood warning plan should be developed, including round-the-clock monitoring during heavy rainfall.

7.4 Alternatives

There appear to be no practical alternatives to the above recommendations.

APPENDIX A
INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT Portland Reservoir Dam

DATE 24 April and 9 May 1979

TIME 2:00 PM

April 24 - Clear & Warm

WEATHER May 9 - Clear & Hot

W.S. ELEV. 312.6 U.S. DN.S.

PARTY:

- | | |
|--------------------------------|--------------------------------|
| 1. <u>Peter B. Dyson</u> | 6. <u>Joseph Seiserman</u> |
| 2. <u>Pasquale E. Corsetti</u> | 7. <u>Edwin Marcum</u> |
| 3. <u>Carl J. Hoffman</u> | 8. <u> </u> |
| 4. <u>Roger F. Berry</u> | 9. <u> </u> |
| 5. <u>James Reynolds</u> | 10. <u> </u> |

PROJECT FEATURE	INSPECTED BY	REMARKS
1. <u>Hydrologic</u>	<u>Roger F. Berry</u>	<u> </u>
2. <u>Hydraulics/Structures</u>	<u>Carl J. Hoffman</u>	<u> </u>
3. <u>Soils and Geology</u>	<u>James Reynolds</u>	<u> </u>
4. <u>General Features</u>	<u>Peter B. Dyson</u>	<u> </u>
5. <u>General Features</u>	<u>Pasquale E. Corsetti</u>	<u> </u>
6. <u> </u>	<u> </u>	<u> </u>
7. <u> </u>	<u> </u>	<u> </u>
8. <u> </u>	<u> </u>	<u> </u>
9. <u> </u>	<u> </u>	<u> </u>
10. <u> </u>	<u> </u>	<u> </u>

PERIODIC INSPECTION CHECKLIST

PROJECT Portland Reservoir Dam DATE 24 April and 9 May 1979
 PROJECT FEATURE Earthfill Dam NAME _____
 DISCIPLINE Soils/Geology NAME James Reynolds

AREA EVALUATED	CONDITIONS
<u>DAM EMBANKMENT</u>	
Crest Elevation	317.0 left abutment 318.5 right abutment
Current Pool Elevation	312.6
Maximum Impoundment to Date	314.3+
Surface Cracks	None
Pavement Condition	Not applicable
Movement or Settlement of Crest	None
Lateral Movement	None
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	Frequent
Sloughing or Erosion of Slopes or Abutments	Upstream face locally eroded through wave action.
Rock Slope Protection - Riprap Failures	See Note (1) - next page
Unusual Movement or Cracking at or near Toes	None
Unusual Embankment or Downstream Seepage	Seepage around outlet of underdrain collector, 200 ft. downstream of dam
Piping or Boils	None
Foundation Drainage Features	See Note (2) - next page
Toe Drains	See Note (3) - next page
Instrumentation System	None

Dam Embankment Notes

- (1) Riprap dislodged at downstream ends of both spillway wingwalls.
Riprap not sufficient on upstream face, particularly near gate house.
- (2) Popcorn drains beneath heel of spillway and spillway apron; functional collector outfalls 200 ft. downstream at 1-2 gpm.
- (3) Toe drains functional at 0.5 gpm right, 0.1 gpm left. Surface drain outlets above right toe drain.

PERIODIC INSPECTION CHECKLIST

PROJECT Portland Reservoir Dam DATE 24 April and 9 May 1979
 PROJECT FEATURE R. Abutment Closure Dike NAME _____
 DISCIPLINE Soils/Geology NAME James Reynolds

AREA EVALUATED	CONDITIONS
----------------	------------

DIKE EMBANKMENT

Crest Elevation	Varies from 316.5 to 318.5
Current Pool Elevation	312.6
Maximum Impoundment to Date	314.3(+)
Surface Cracks	None
Pavement Condition	Not applicable
Movement or Settlement of Crest	None
Lateral Movement	None
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	Frequent
Sloughing or Erosion of Slopes or Abutments	Yes, extensive erosion along upstream face
Rock Slope Protection - Riprap Failures	No longer evident
Unusual Movement or Cracking at or near Toes	None evident
Unusual Embankment or Downstream Seepage	None evident
Piping or Boils	None evident
Foundation Drainage Features	None evident
Toe Drains	None evident
Instrumentation System	None evident

PERIODIC INSPECTION CHECKLIST

PROJECT Portland Reservoir Dam DATE 24 April and 9 May 1979
 PROJECT FEATURE Gate House NAME C. Hoffman
 DISCIPLINE Structures NAME _____

AREA EVALUATED	CONDITIONS
<u>OUTLET WORKS - CONTROL TOWER</u>	

a. Concrete and Structural

General Condition	Fair
Condition of Joints	Minor deterioration
Spalling	None
Visible Reinforcing	N/A
Rusting or Staining of Concrete	None
Any Seepage or Efflorescence	None
Joint Alignment	Good
Unusual Seepage or Leaks in Gate Chamber	None Evident
Cracks	Minor
Rusting or Corrosion of Steel	N/A

b. Mechanical and Electrical

Air Vents	N/A
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lighting Protection System	
Emergency Power System	
Wiring and Lighting System in Gate Chamber	

PERIODIC INSPECTION CHECKLIST

PROJECT Portland Reservoir Dam DATE 24 April and 9 May 1979
 PROJECT FEATURE Outlet Works NAME James Reynolds
 DISCIPLINE Structures/Hydraulics/Soils NAME Carl Hoffman

AREA EVALUATED	CONDITIONS
<u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u>	

- | | |
|------------------------------|-------------------------|
| a. Approach Channel | N/A |
| Slope Conditions | |
| Bottom Conditions | |
| Rock Slides or Falls | |
| Log Boom | |
| Debris | |
| Condition of Concrete Lining | |
| Drains or Weep Holes | |
| b. Intake Structure | Wet well and gate house |
| Condition of Concrete | Brick structure - fair |
| Stop Logs and Slots | None |

PERIODIC INSPECTION CHECKLIST

PROJECT Portland Reservoir Dam DATE 24 April and 9 May 1979
 PROJECT FEATURE Outlet Channel NAME _____
 DISCIPLINE Hydraulics/Structures NAME Carl Hoffman

AREA EVALUATED	CONDITIONS
----------------	------------

OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL

General Condition of Concrete	Outlet Channel is a natural channel
Rust or Staining	Not applicable
Spalling	Not applicable
Erosion or Cavitation	Not applicable
Visible Reinforcing	Not applicable
Any Seepage or Efflorescence	Not applicable
Condition at Joints	Not applicable
Drain Holes	None
Channel	
Loose Rock or Trees Overhanging Channel	Some trees
Condition of Discharge Channel	Growth in channel

PERIODIC INSPECTION CHECKLIST

PROJECT Portland Reservoir Dam DATE 24 April and 9 May 1979
 PROJECT FEATURE Spillway NAME _____
 DISCIPLINE Structures NAME Carl Hoffman

AREA EVALUATED	CONDITIONS
----------------	------------

OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS

- | | |
|--------------------------------|--|
| a. Approach Channel | None |
| General Condition | Not applicable |
| Loose Rock Overhanging Channel | Not applicable |
| Trees Overhanging Channel | Not applicable |
| Floor of Approach Channel | Not applicable |
| b. Weir and Training Walls | |
| General Condition of Concrete | Fair to Good |
| Rust or Staining | Minor |
| Spalling | Some spalling on top panel, left side of spillway. |
| Any Visible Reinforcing | No |
| Any Seepage or Efflorescence | Yes. Leaking joint at left downstream wingwall. |
| Drain Holes | Yes |
| c. Discharge Channel | |
| General Condition | Good |
| Loose Rock Overhanging Channel | No |
| Trees Overhanging Channel | Some |
| Floor of Channel | Light growth in floor of channel |
| Other Obstructions | None |

PERIODIC INSPECTION CHECKLIST

PROJECT Portland Reservoir Dam DATE 24 April and 9 May 1979

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITIONS
----------------	------------

Outlet Works-Transition and Conduit	N/A
-------------------------------------	-----

Outlet Works-Service Bridge	N/A
-----------------------------	-----

APPENDIX B
ENGINEERING DATA

STATE OF CONNECTICUT

WATER RESOURCES COMMISSION
STATE OFFICE BUILDING • HARTFORD 15, CONNECTICUT

CERTIFICATE OF APPROVAL

November 19, 1964

3

Portland Connecticut Water Works
Town Hall
Portland, Connecticut

TOWN: Portland
RIVER: Reservoir Brook
TRIBUTARY:
CODE NO.: C 31.5 R 2.0

Gentlemen:

NAME AND LOCATION OF STRUCTURE: Portland Water Works Dam
located south of Old Marlborough Turnpike in the Town of Portland.

DESCRIPTION OF STRUCTURE AND WORK PERFORMED: Construction of
dam at an existing site on Reservoir Brook in accordance with
plans prepared by Argraves Engineers dated May 6, 1963.

CONSTRUCTION PERMIT ISSUED UNDER DATE OF: August 26, 1963

This certifies that the work and construction included in
the plans submitted, for the structure described above, has been
completed to the satisfaction of this Commission and that this
structure is hereby approved in accordance with Section 25-114
of the 1958 Revision of the General Statutes.

The owner is required by law to record this Certificate in
the land records of the town or towns in which the structure is
located.

WATER RESOURCES COMMISSION

BY: _____
William S. Wise, Director

JOHN J. MOZZOCHI AND ASSOCIATES
CIVIL ENGINEERS

JOHN J. MOZZOCHI

ASSOCIATES

OWEN J. WHITE
JOHN LUCHS, JR.
ECTOR L. GIOVANNINI

November 2, 1964

GLASTONBURY, CONN.
217 HEBRON AVENUE
PHONE 633-9401

PROVIDENCE 3, R. I.
200 DYER STREET
PHONE GASPEE 1-0420

William P. Sander-Engineer-Geologist
Water Resources Commission
State Office Building
Hartford 15, Connecticut

REPLY TO: Glastonbury

SEARCHED	INDEXED
SERIALIZED	FILED

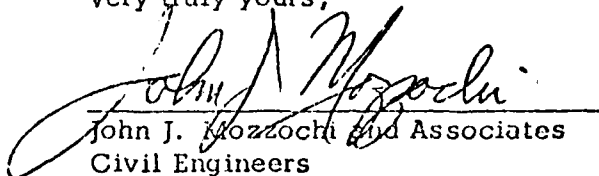
Re: Our File 57-73-58
Portland Reservoir Dam
Portland, Connecticut

Dear Mr. Sander:

The referenced dam has been under construction since March, 1964. At the request of Newman Argraves, Consulting Engineer for the Portland Water Company, I made a final inspection of the project on October 30, 1964. I had made three previous inspection visits to this project while it was under construction and can certify that it was built in substantial conformity to the plans.

I recommend that a Final Permit be issued for this project.

Very truly yours,


John J. Mozzochi and Associates
Civil Engineers

JJM:hk

BOARD OF SELECTMEN
TOWN OF PORTLAND

P. O. BOX 71

PORTLAND, CONN.

July 17, 1963

Mr. William S. Wise
Water Resources Commission
State Office Building
Hartford, Connecticut

Dear Mr. Wise:

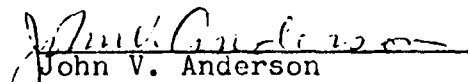
I am enclosing 2 copies of Application For
Construction Permit For Dam, for the Portland Connecticut
Water Works.

Under separate coverage, I am forwarding to your
attention 2 sets of plans and specifications on the dam,
for your inspection and approval.

If there is anything further needed, please do
not hesitate to notify me. I would appreciate your advising
me of the results as soon as possible.

Thanking you, I am

Very truly yours,


John V. Anderson
First Selectman

JVA:S

STATE WATER RESOURCES COMMISSION RECEIVED JUL 18 1963 ANSWERED..... REFERRED..... FILED.....
--

July 23, 1963

Mr. John J. Mozzochi
Consulting Engineer
217 Hebron Avenue
Glastonbury, Connecticut

Dear Mr. Mozzochi:

Under the terms of your contract as consultant to this Commission, would you please review the enclosed plans for the proposed Portland Water Works Dam and notify this office of your recommendations as to whether a construction permit should be issued or not.

Very truly yours,

William P. Sander
Engineer - Geologist

WPS:dlp
enc.

FORM D-7

STATE OF CONNECTICUT
WATER RESOURCES COMMISSION
State Office Building
Hartford, Connecticut

COMMISSION
RECEIVED

JUL 10 1963

ANSW. R.D.

REFERRED

FILED

July 9, 1963

APPLICATION FOR CONSTRUCTION PERMIT FOR DAM

Owner PORTLAND CONNECTICUT WATER WORKS

Date _____

P.O. Address Town Hall Portland, Connecticut

Tel. No. DI 2-2880

Location of Structure:

Town Portland, Conn.

Shown on USGS Quadrangle Middle Haddam

Name of Stream Reservoir Brook

at 5 1/2 inches south of Lat. 41-37'-30"
north
and 7 inches east of Long. 72-37'-30"
west

Directions for reaching site from nearest village or route intersection:
(see sketch on reverse side) Directions below are from Portland, Conn.

Take Route 17 North about 3 miles to Fogelmarks Corners thence follow Old Marlborough

Turnpike 2.2 Miles to the site.

This is an application for: (New Construction) (Alteration) (Repair) (Removal)
(check one or more of above)

This pond is to be used for: Water Supply Reservoir

Dimensions of Pond: width 1000' length 2300' area 40+ Acres

Maximum depth of water immediately above dam: 27'

Total length of dam: 850' ±

Length of spillway: 94'

Height of abutments above spillway: 6 1/2'

Type of spillway construction: Concrete

Type of dike construction: Earth Embankment

Spillway section will be set on: (Bedrock) (Gravel) (Clay) (Till)
(check one of above)

Remarks: _____

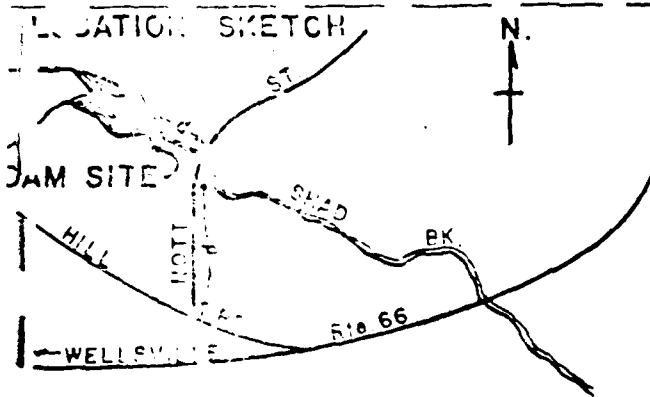
Signed: John V. Anderson

(owner)

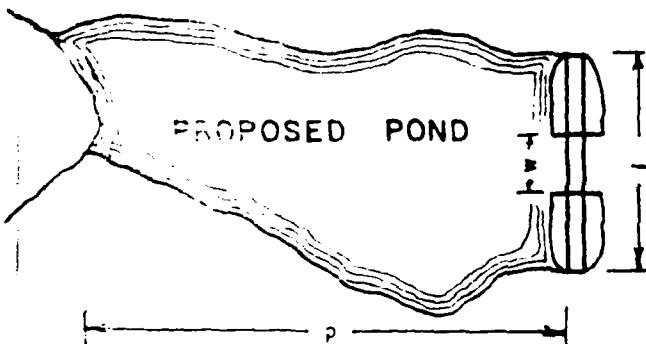
Name of Engineer, if any ARGRAVES ENGINEERS

Note: Show details of _____

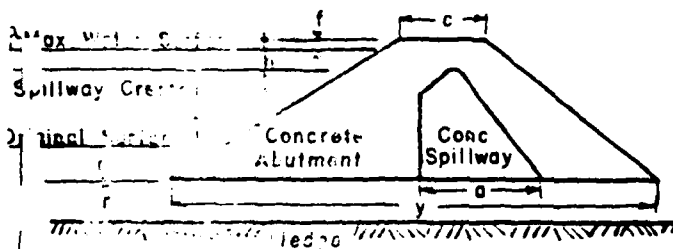
SAMPLE DATA



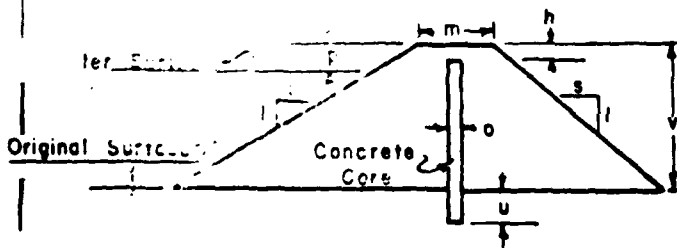
SITE PLAN



SPILLWAY SECTION



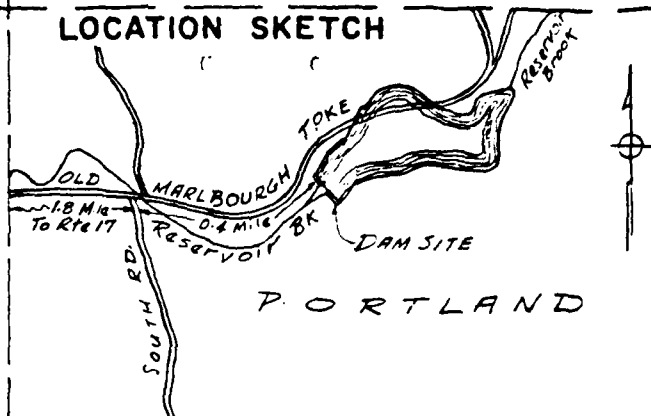
DIKE SECTION



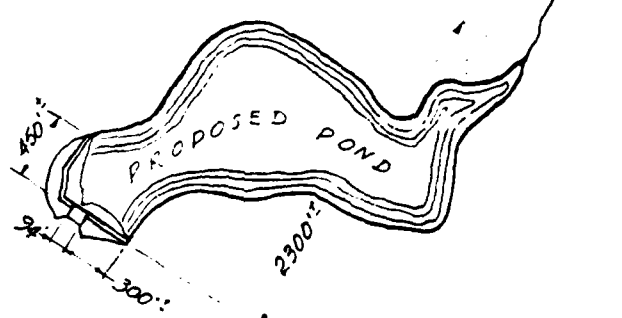
APPLICANT'S DATA

Show only features of sample which are applicable and dimensions which reflect your intent.

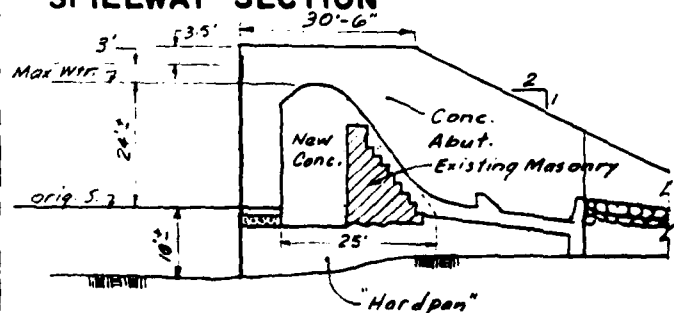
LOCATION SKETCH



SITE PLAN

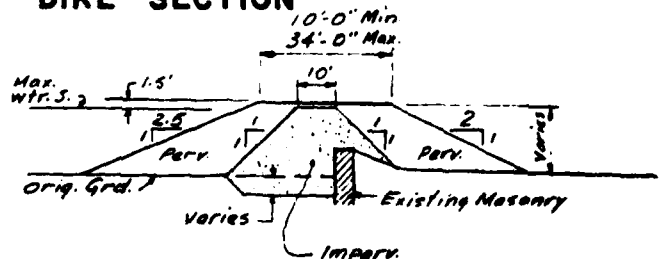


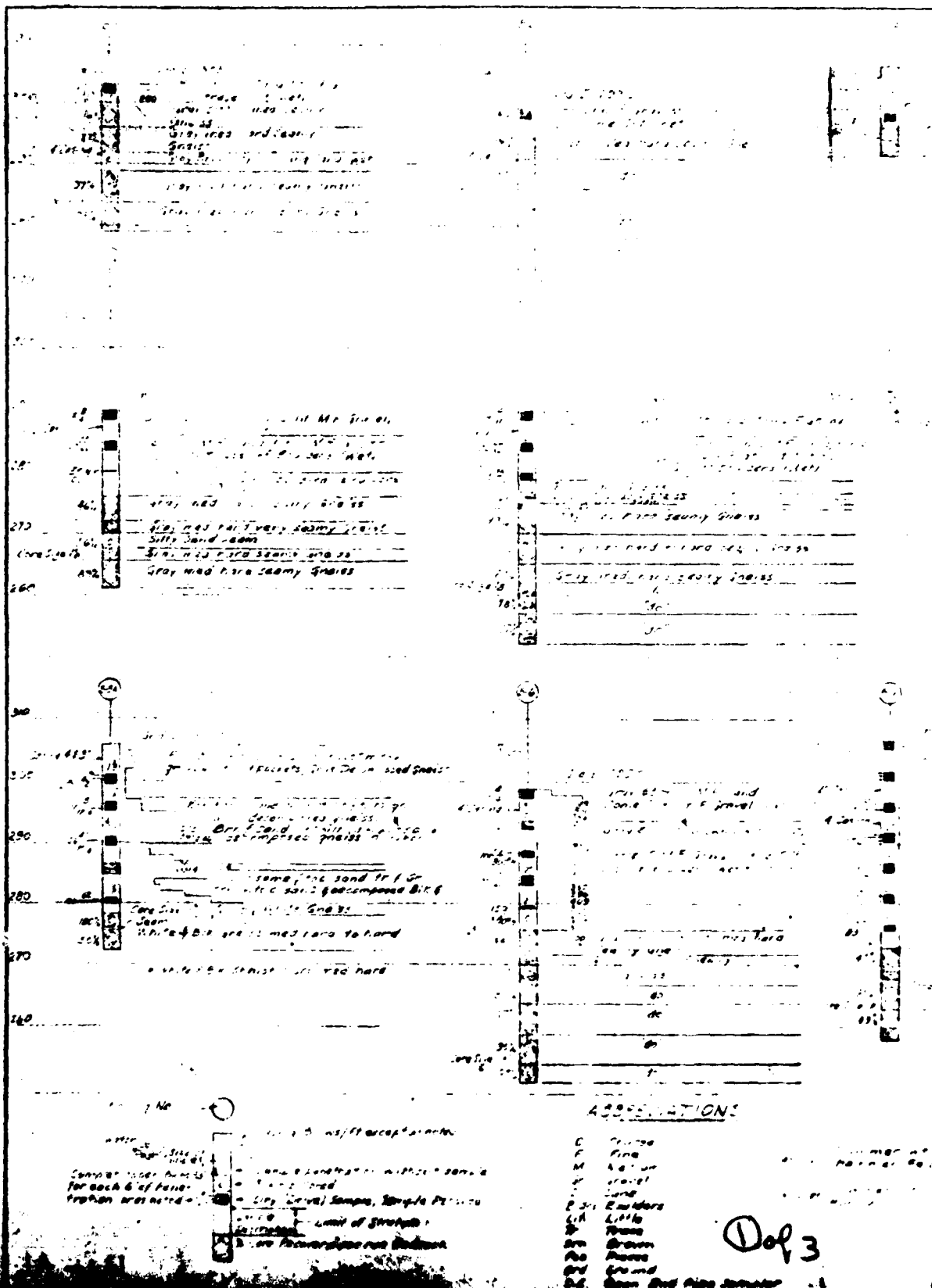
SPILLWAY SECTION



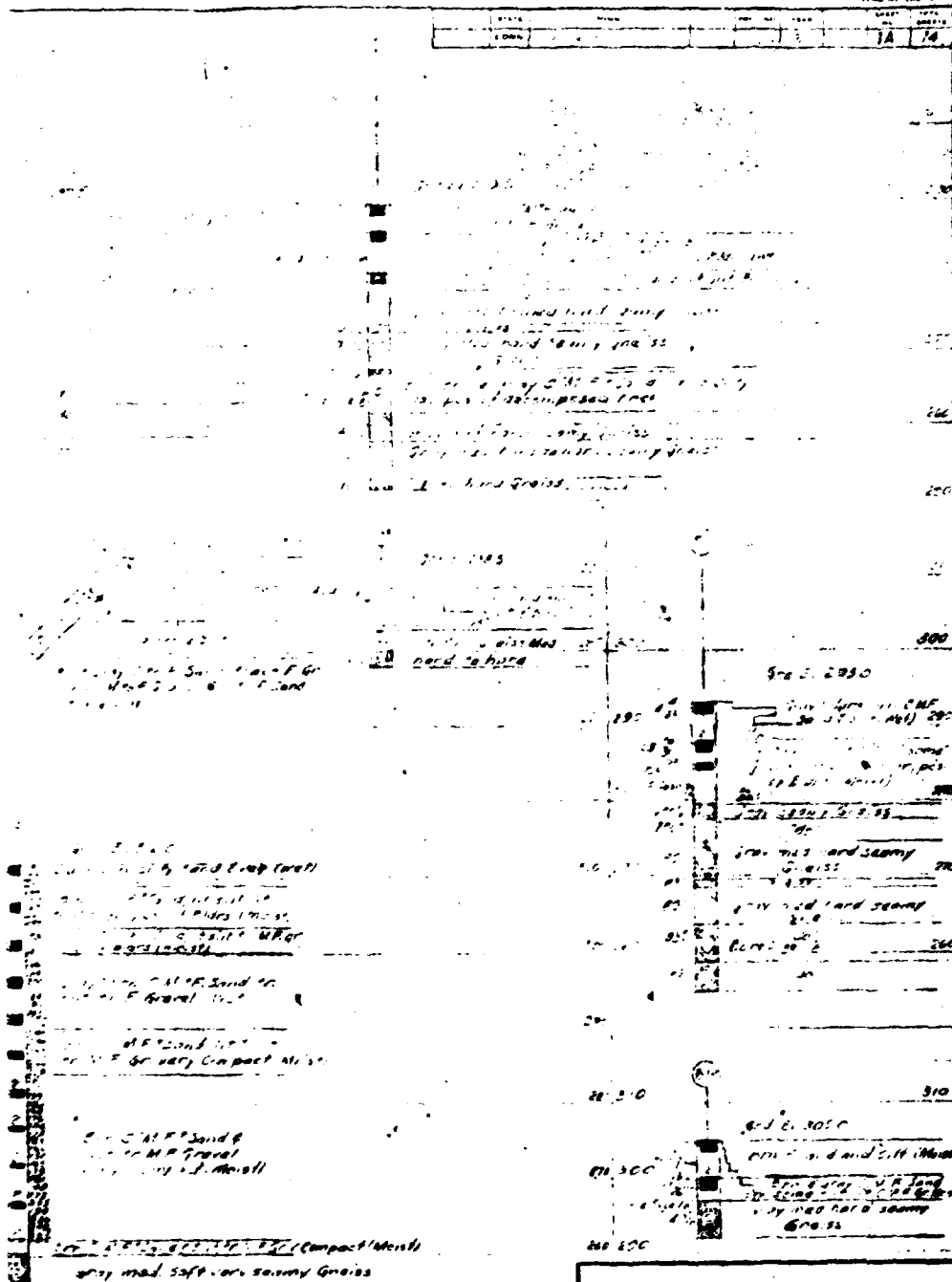
NOTE... If there are two methods of discharge Show Both

DIKE SECTION





STATE	CONTRACT	DATE	NO.	1A	74
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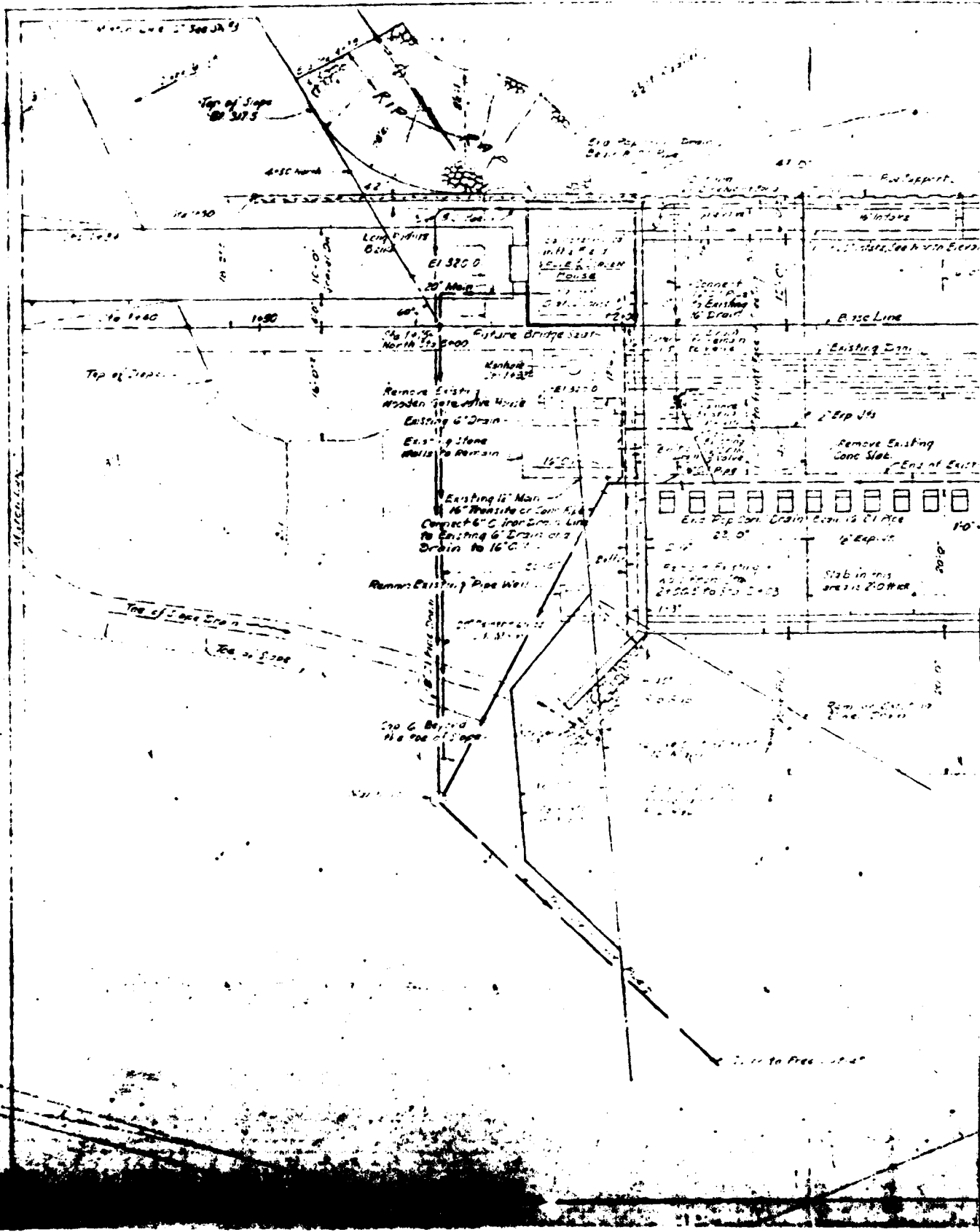


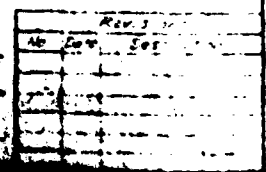
DAM FOR THE PORTLAND, CT. WATER WORKS BORINGS

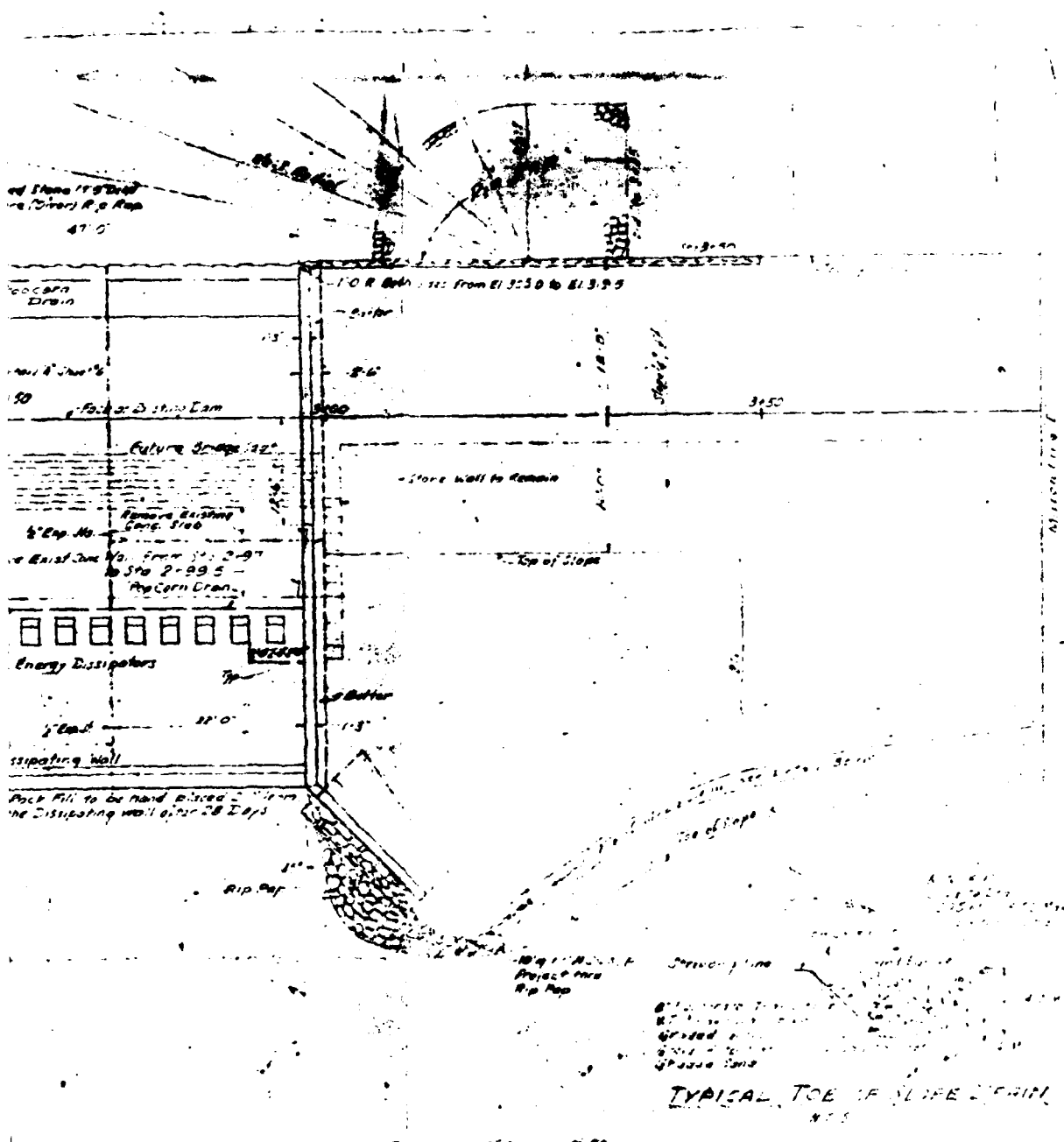
NO	DATE	DESCRIPTION

NOTE: FOR GENERAL NOTES SEE SHEET #4

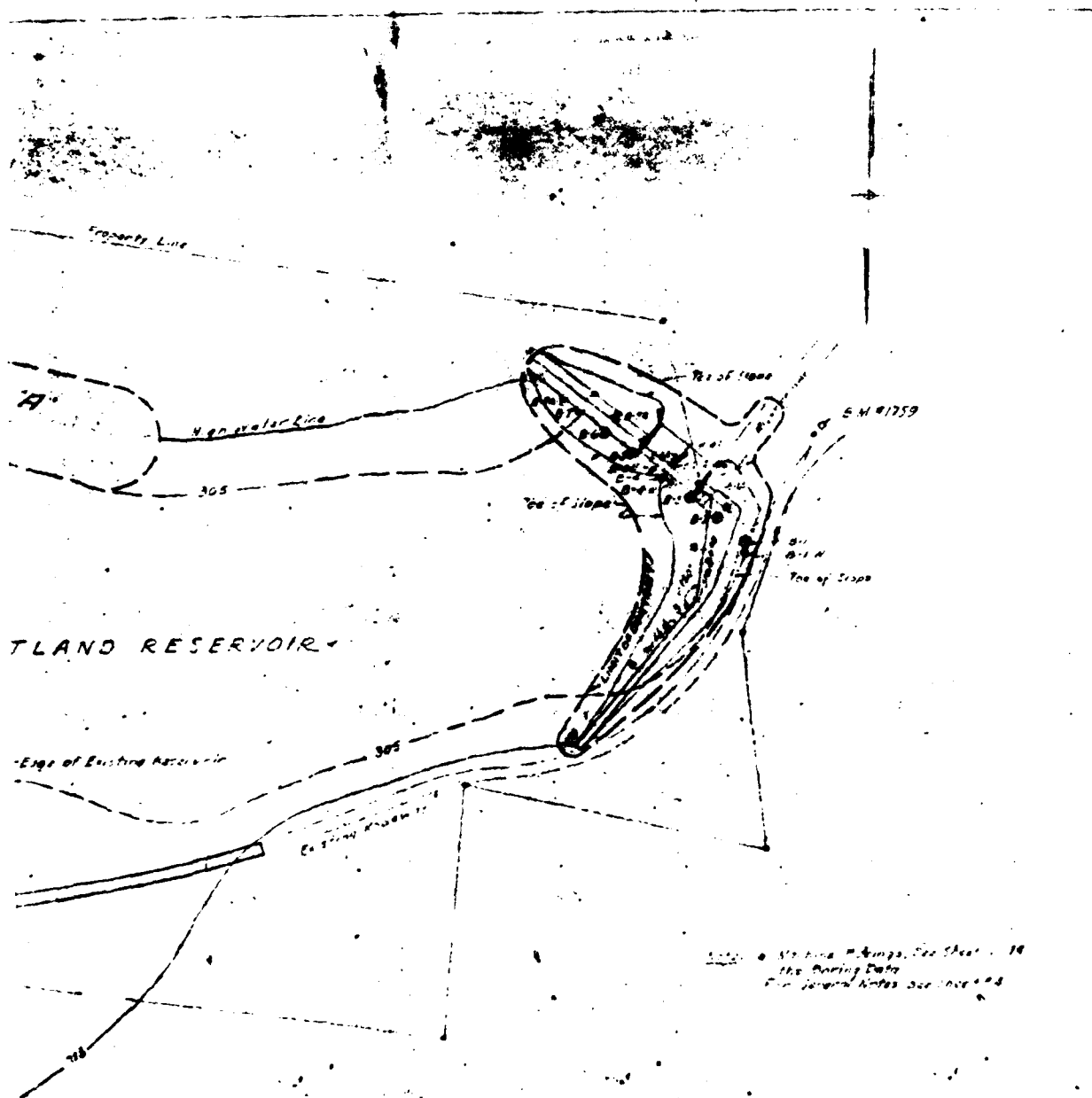
3 of 3







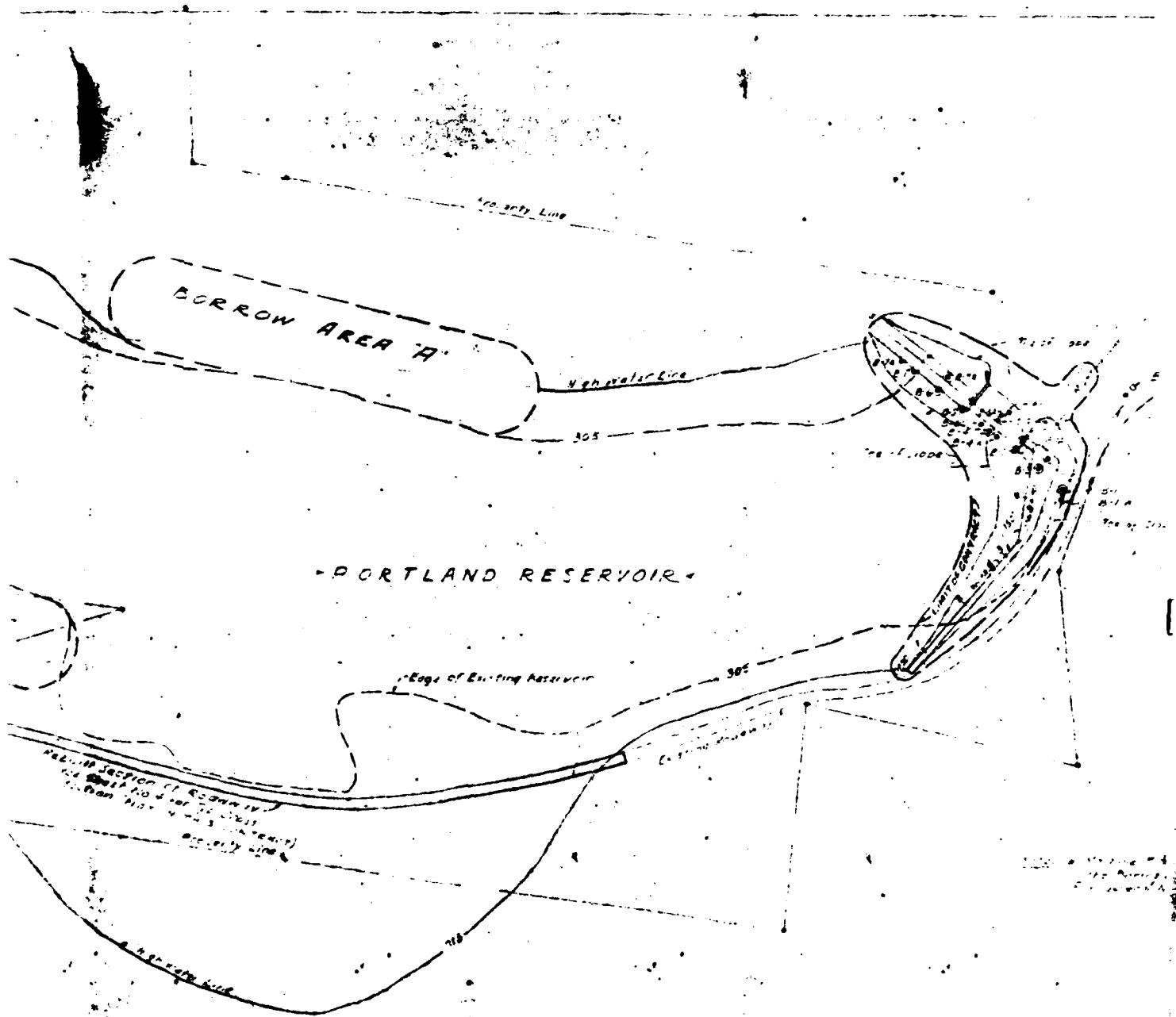
DAM FOR THE PORTLAND, CT. WATER WORKS PLAN	
Date: 6-1-0 Prepared by: M.E. Checked by: M.E. Drawn by: M.E.	622A 14



DAM FOR THE PORTLAND, CT. WATER WORKS GENERAL PLAN

Scale 1" = 100'

Sheet 18 of 18
Date 6-2-21
A

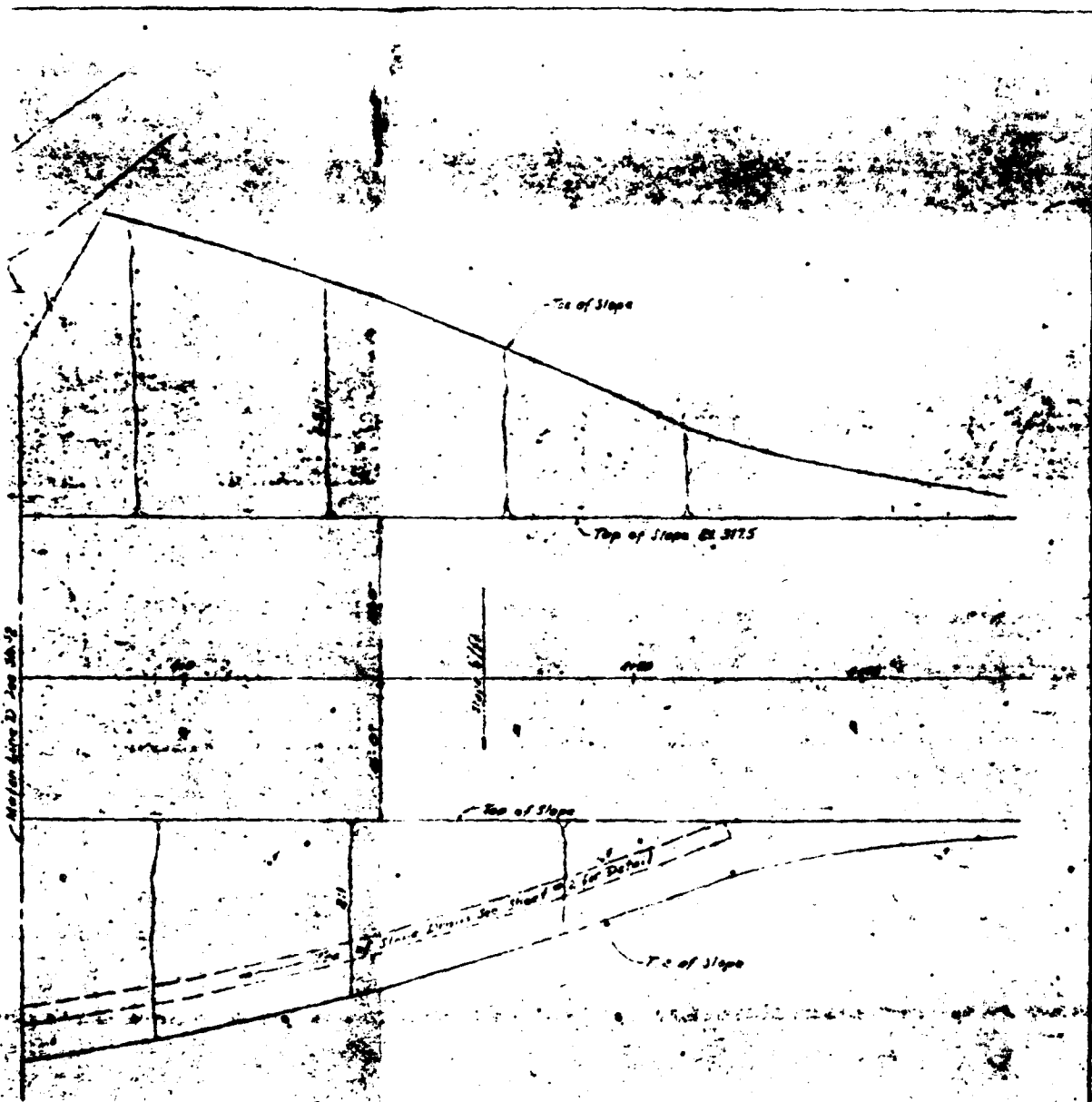


GENERAL PLAN
Scale 1" = 100'

DAM
FOR
WATER
GEN

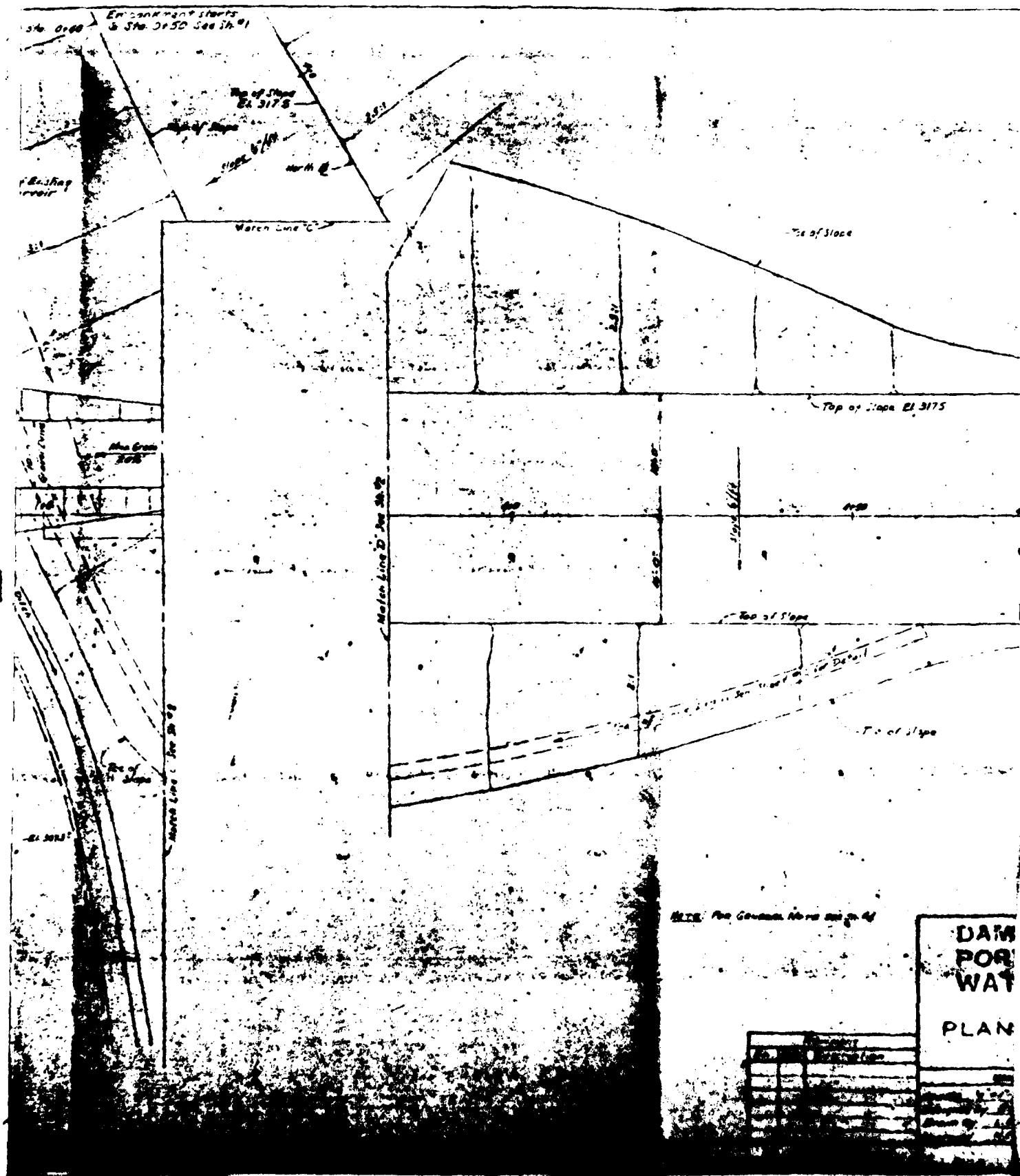
Revisions		
No.	Date	Description

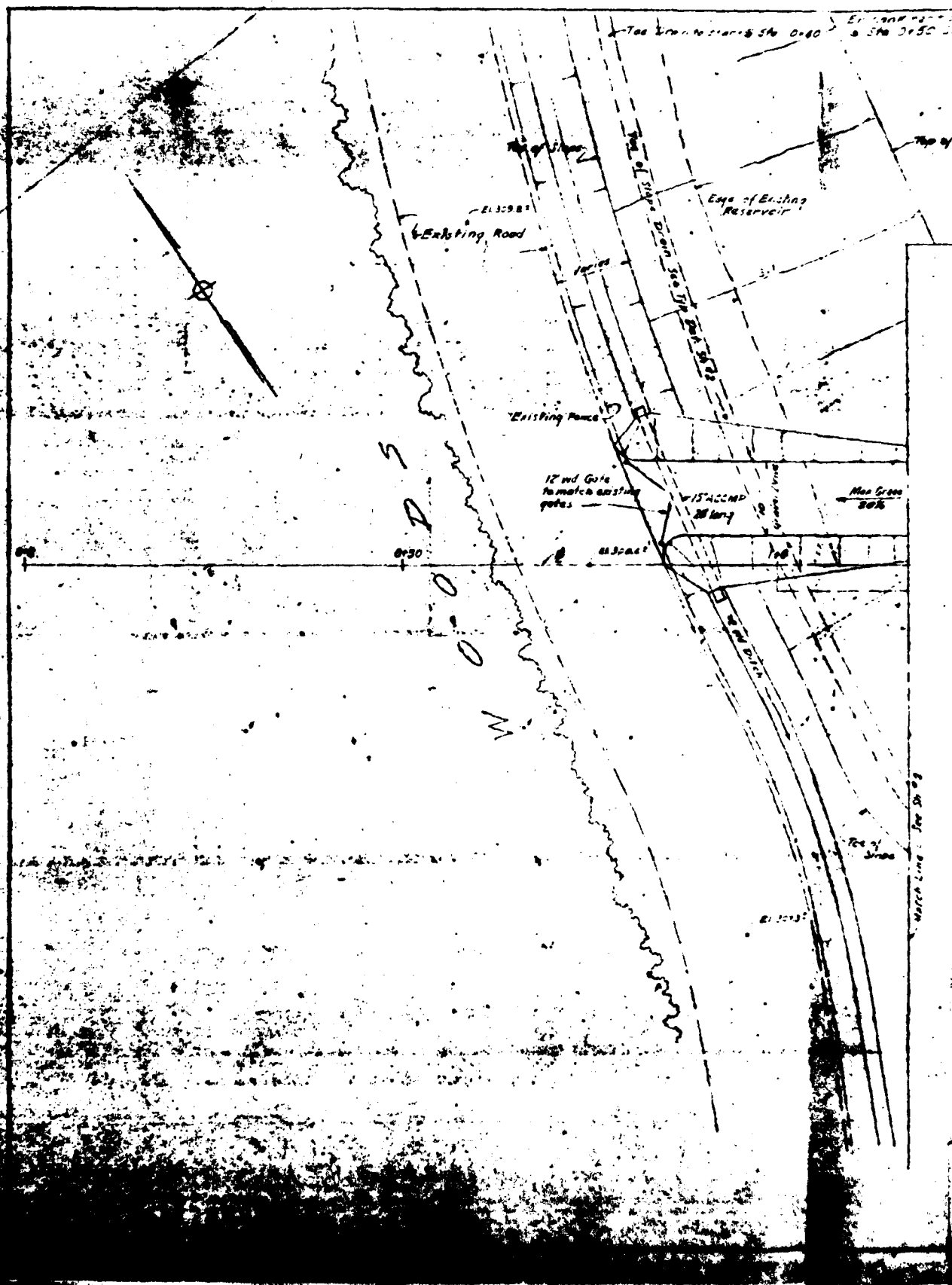
Drawn by E. A.
Approved by E. A.

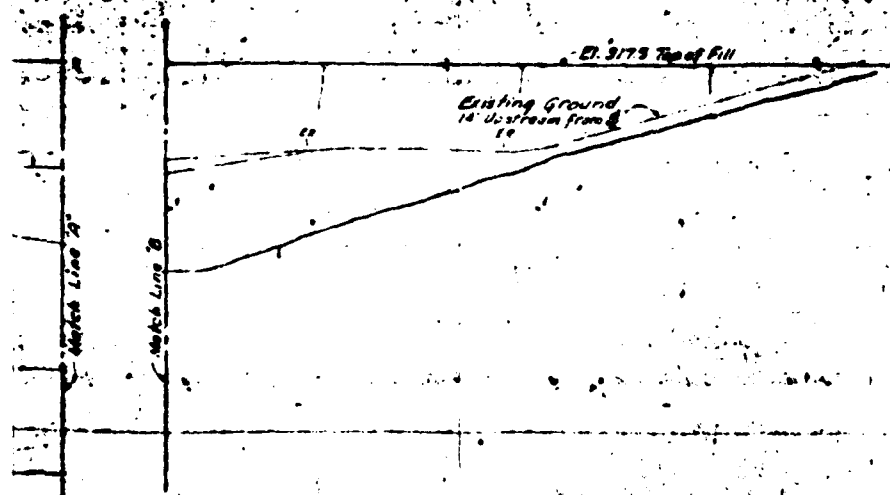
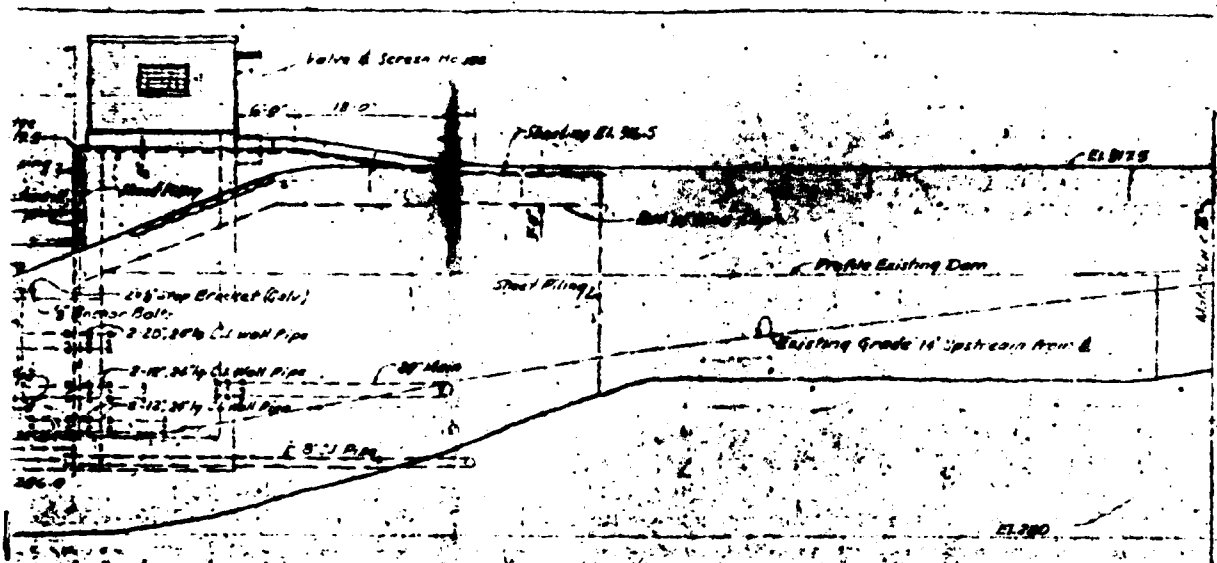


NOTE: For General Notes see page 34-12

DAM FOR THE
PORTLAND, CT.
WATER WORKS
PLAN CONTINUED







ELEVATION CONTINUED

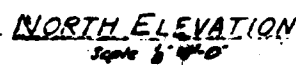
NOTE: REFER TO SHEET NO. 10 FOR GENERAL NOTES.

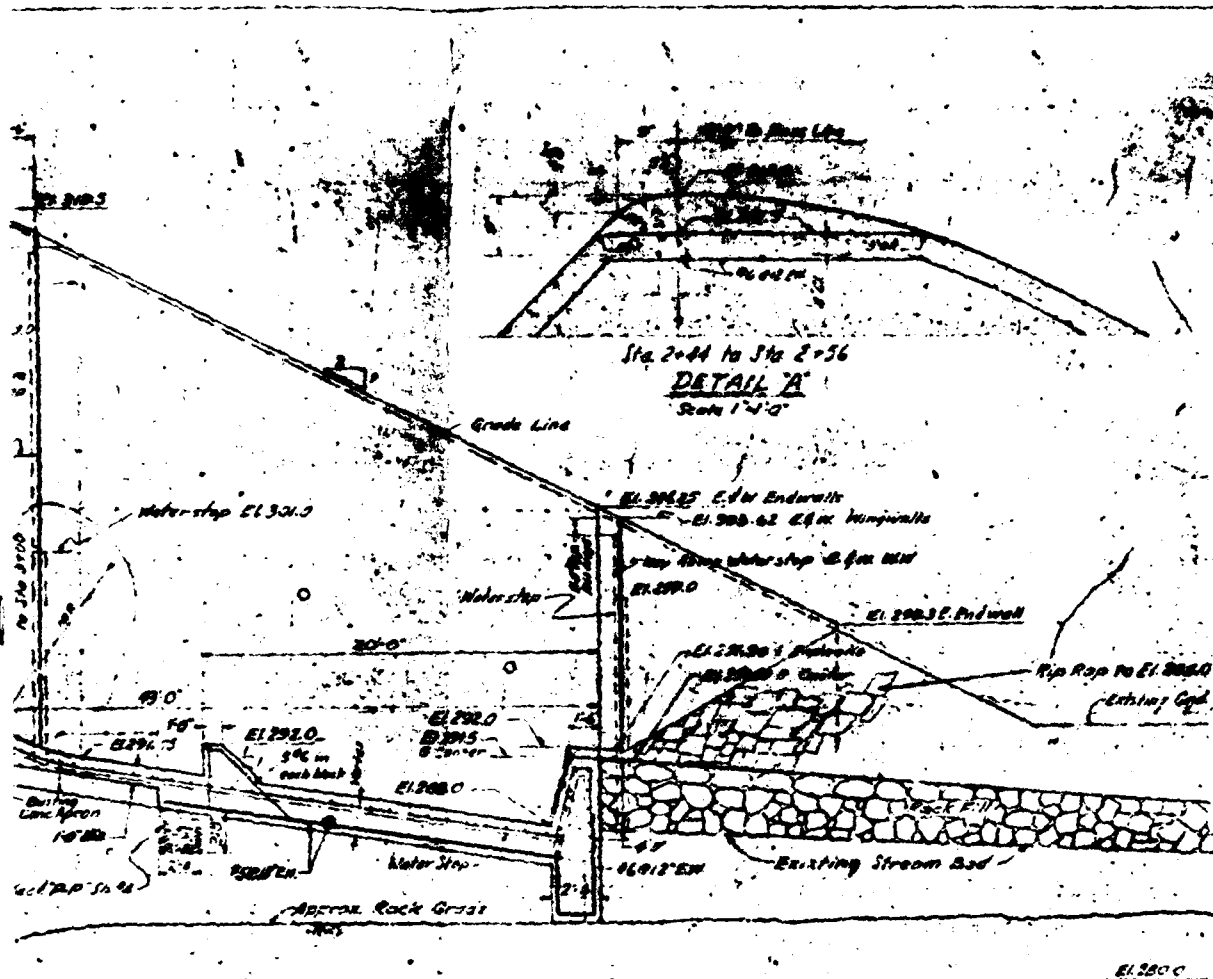
DAM FOR THE PORTLAND, CT. WATER WORKS

NORTH ELEVATION

Drawn by Approved Engineer

629
5





105 TO STA 2+97

NOTE: REFER TO SHEET 14 FOR
GENERAL NOTES

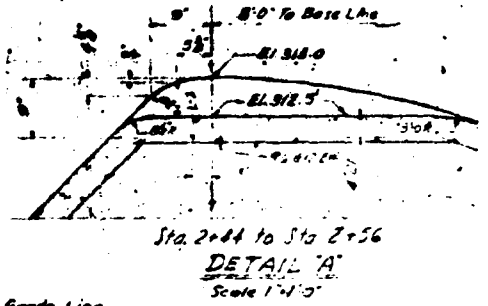
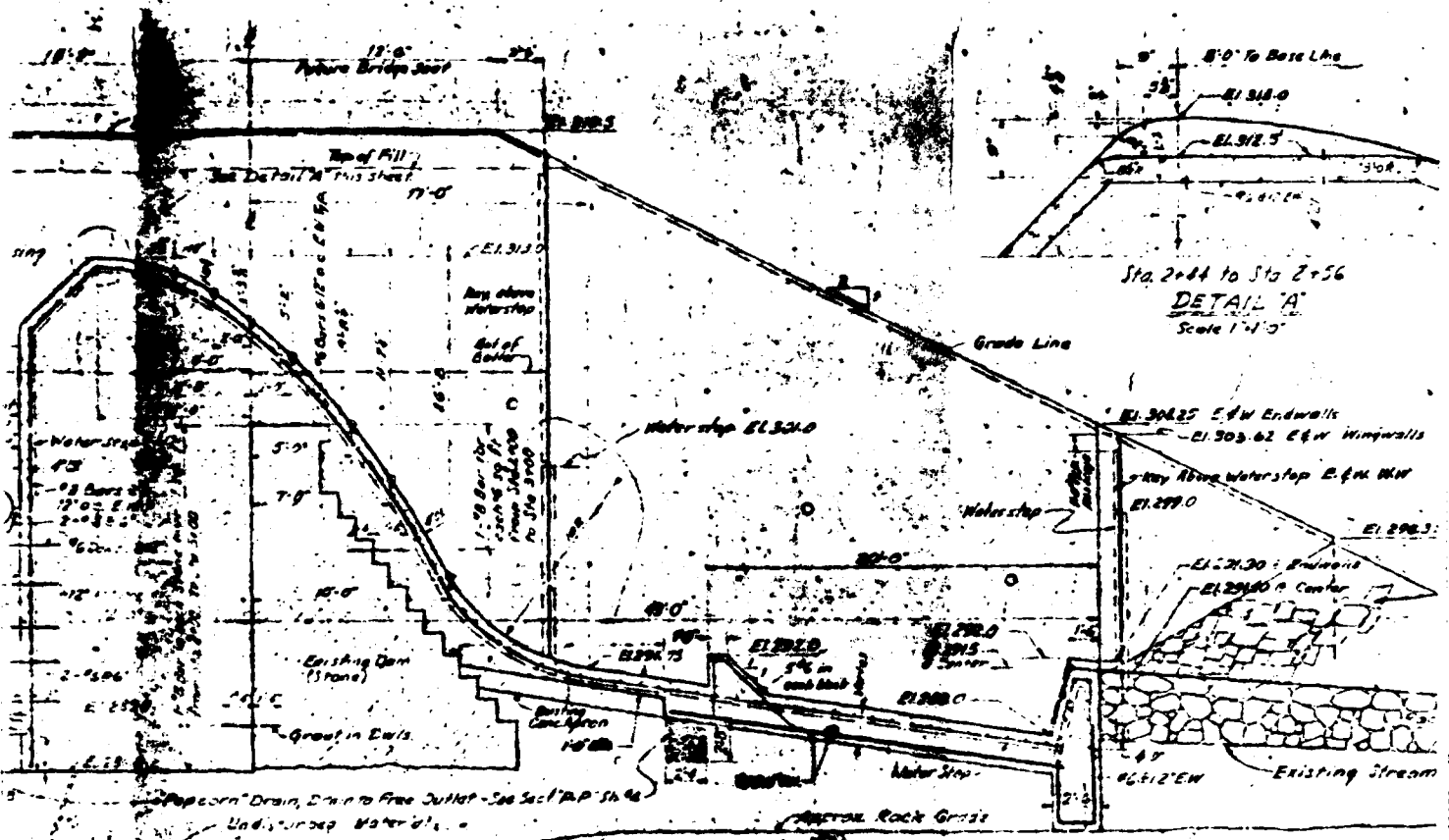
DAM FOR THE PORTLAND, CT. WATER WORKS

**STRUCTURAL DETAILS
AND
CROSS SECTIONS**

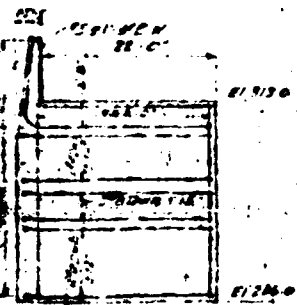
REVISIONS

Drawn by: J. M. [illegible]
Checked by: J. M. [illegible]
Date: [illegible]

62



TYPICAL CROSS SECTION FROM STA. 2+09 TO STA. 2+27
Scale 1"=1'-0"



NOTE: REFER TO SHEET 14 FOR GENERAL NOTES

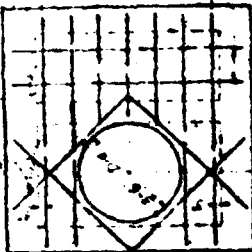
**DAI
POI
WA
STRUC
CROS**

REVISIONS	
No.	Description

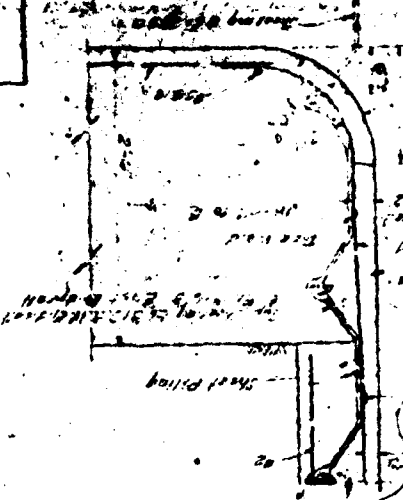
Scale
Designed by
Drawn by
Checked

STRUCTURAL DETAILS WATER WORKS PORTLAND, CT.

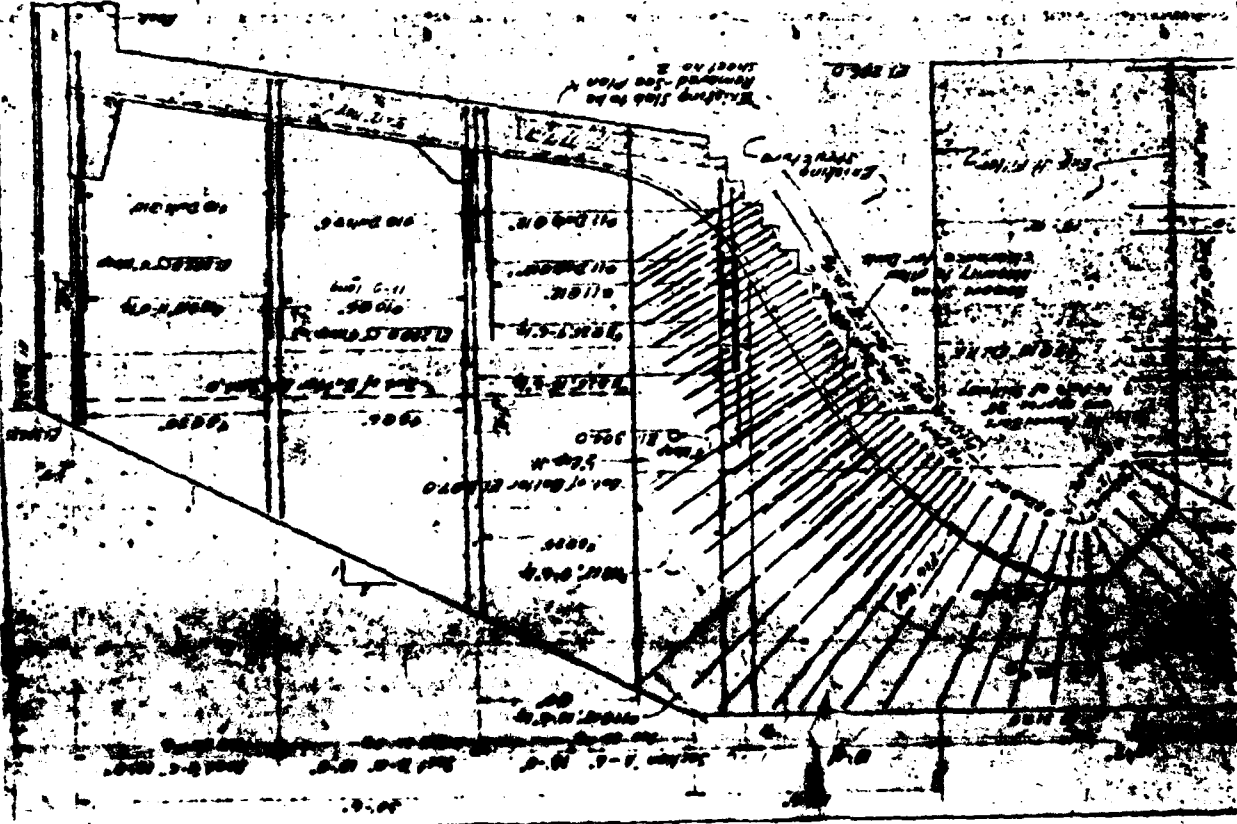
SLAB FOR EXISTING
WET WELL COVER



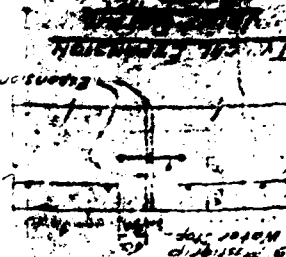
SECTION M-M



EAST END WALL ELEVATION



NO.	DESCRIPTION	QUANTITY	UNIT
1	Concrete		
2	Reinforcing Steel		
3	Formwork		
4	Grout		
5	Paint		



WALL

WALL

WALL

WALL

DATE	10/10/54	TIME	10:00
LOCATION	1000 10th St. S. S.W.		
REMARKS	1. 1000 10th St. S. S.W.		
	2. 1000 10th St. S. S.W.		
	3. 1000 10th St. S. S.W.		
	4. 1000 10th St. S. S.W.		
	5. 1000 10th St. S. S.W.		
	6. 1000 10th St. S. S.W.		
	7. 1000 10th St. S. S.W.		
	8. 1000 10th St. S. S.W.		
	9. 1000 10th St. S. S.W.		
	10. 1000 10th St. S. S.W.		
	11. 1000 10th St. S. S.W.		
	12. 1000 10th St. S. S.W.		
	13. 1000 10th St. S. S.W.		
	14. 1000 10th St. S. S.W.		
	15. 1000 10th St. S. S.W.		
	16. 1000 10th St. S. S.W.		
	17. 1000 10th St. S. S.W.		
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	20. 1000 10th St. S. S.W.		
	21. 1000 10th St. S. S.W.		
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	23. 1000 10th St. S. S.W.		
	24. 1000 10th St. S. S.W.		
	25. 1000 10th St. S. S.W.		
	26. 1000 10th St. S. S.W.		
	27. 1000 10th St. S. S.W.		
	28. 1000 10th St. S. S.W.		
	29. 1000 10th St. S. S.W.		
	30. 1000 10th St. S. S.W.		
	31. 1000 10th St. S. S.W.		
	32. 1000 10th St. S. S.W.		
	33. 1000 10th St. S. S.W.		
	34. 1000 10th St. S. S.W.		
	35. 1000 10th St. S. S.W.		
	36. 1000 10th St. S. S.W.		
	37. 1000 10th St. S. S.W.		
	38. 1000 10th St. S. S.W.		
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	40. 1000 10th St. S. S.W.		
	41. 1000 10th St. S. S.W.		
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	43. 1000 10th St. S. S.W.		
	44. 1000 10th St. S. S.W.		
	45. 1000 10th St. S. S.W.		
	46. 1000 10th St. S. S.W.		
	47. 1000 10th St. S. S.W.		
	48. 1000 10th St. S. S.W.		
	49. 1000 10th St. S. S.W.		
	50. 1000 10th St. S. S.W.		
	51. 1000 10th St. S. S.W.		
	52. 1000 10th St. S. S.W.		
	53. 1000 10th St. S. S.W.		
	54. 1000 10th St. S. S.W.		
	55. 1000 10th St. S. S.W.		
	56. 1000 10th St. S. S.W.		
	57. 1000 10th St. S. S.W.		
	58. 1000 10th St. S. S.W.		
	59. 1000 10th St. S. S.W.		
	60. 1000 10th St. S. S.W.		
	61. 1000 10th St. S. S.W.		
	62. 1000 10th St. S. S.W.		
	63. 1000 10th St. S. S.W.		
	64. 1000 10th St. S. S.W.		
	65. 1000 10th St. S. S.W.		
	66. 1000 10th St. S. S.W.		
	67. 1000 10th St. S. S.W.		
	68. 1000 10th St. S. S.W.		
	69. 1000 10th St. S. S.W.		
	70. 1000 10th St. S. S.W.		
	71. 1000 10th St. S. S.W.		
	72. 1000 10th St. S. S.W.		
	73. 1000 10th St. S. S.W.		
	74. 1000 10th St. S. S.W.		
	75. 1000 10th St. S. S.W.		
	76. 1000 10th St. S. S.W.		
	77. 1000 10th St. S. S.W.		
	78. 1000 10th St. S. S.W.		
	79. 1000 10th St. S. S.W.		
	80. 1000 10th St. S. S.W.		
	81. 1000 10th St. S. S.W.		
	82. 1000 10th St. S. S.W.		
	83. 1000 10th St. S. S.W.		
	84. 1000 10th St. S. S.W.		
	85. 1000 10th St. S. S.W.		
	86. 1000 10th St. S. S.W.		
	87. 1000 10th St. S. S.W.		
	88. 1000 10th St. S. S.W.		
	89. 1000 10th St. S. S.W.		
	90. 1000 10th St. S. S.W.		
	91. 1000 10th St. S. S.W.		
	92. 1000 10th St. S. S.W.		
	93. 1000 10th St. S. S.W.		
	94. 1000 10th St. S. S.W.		
	95. 1000 10th St. S. S.W.		
	96. 1000 10th St. S. S.W.		
	97. 1000 10th St. S. S.W.		
	98. 1000 10th St. S. S.W.		
	99. 1000 10th St. S. S.W.		
	100. 1000 10th St. S. S.W.		

SECTION M-M

(Signature)

JOINT COMMISSION
TYPICAL EXHIBIT

PLAN OF WEST WINDMILL

PLAN of EAST WING RAIL

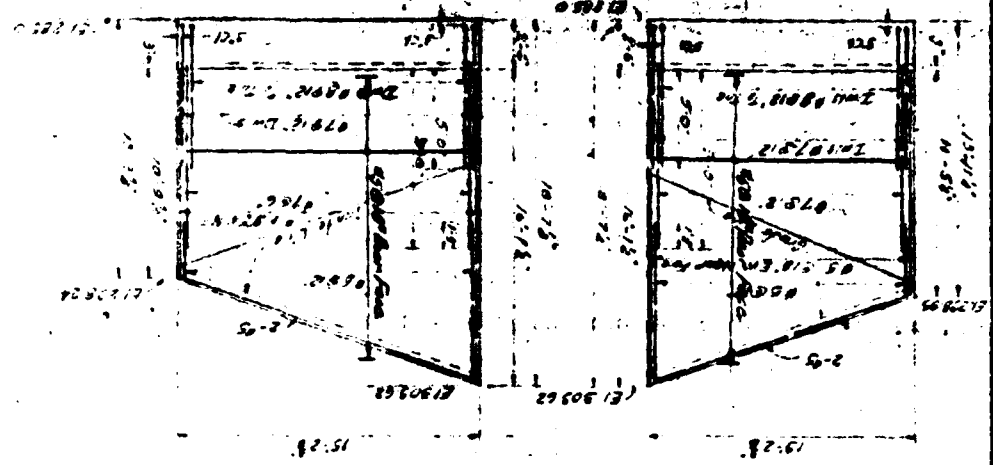
~~EAST ENOWALL ELEVATION~~

NOTIFICATION

SEE FOR GENERAL NOTES AND SCALE IN 4

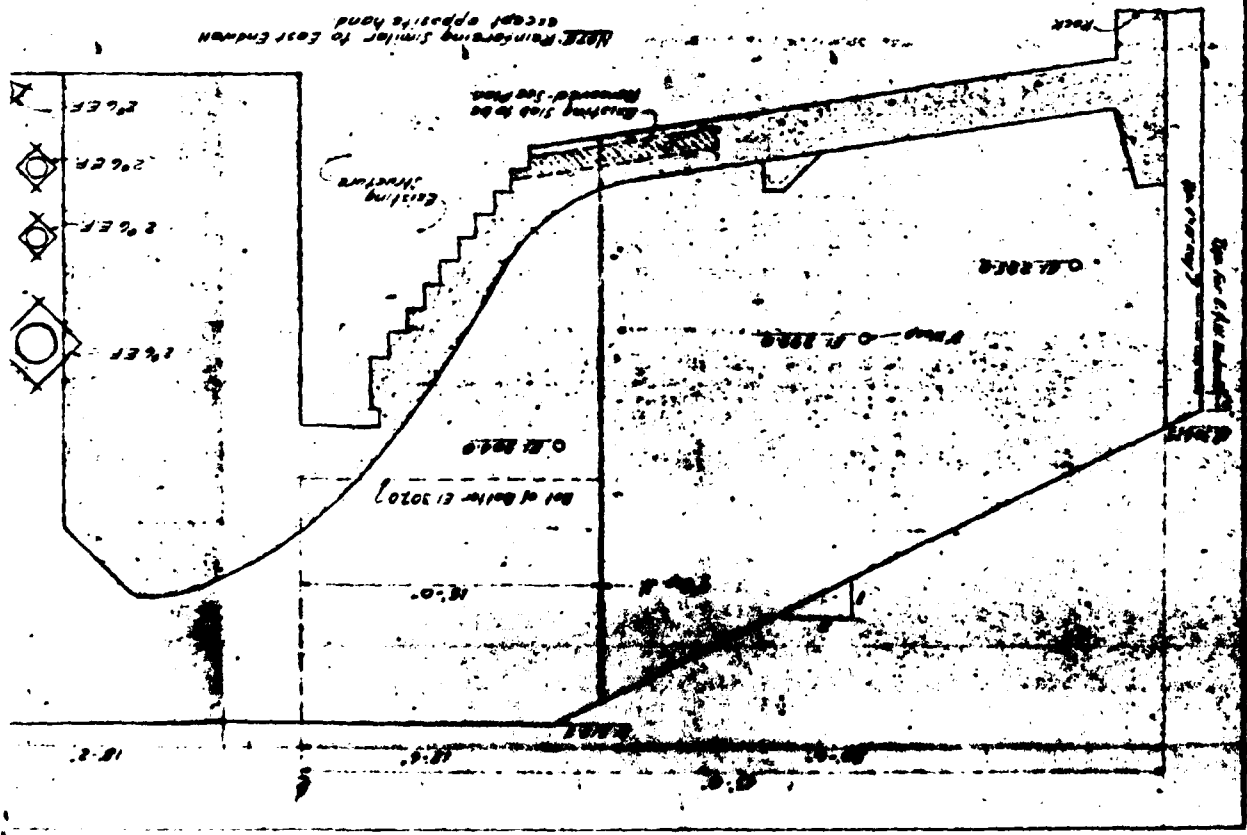
ELEVATION OF E.W.W.

ELEVATION OF W.W.W.



WEST ENDWALL ELEVATION

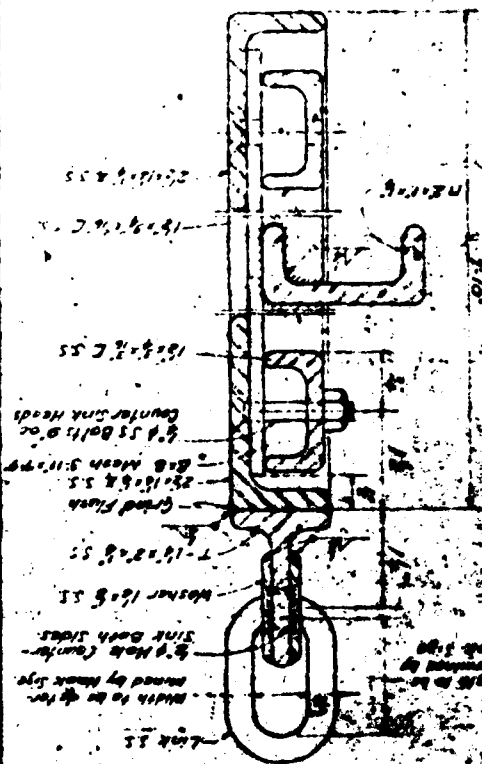
NOTE: Reinforcing similar to East Endwall except opposite hand



**DAM FOR THE
PORTLAND, CT.
WATER WORKS
VALVE & SCREEN HOUSE
DETAILS OF
MECHANICAL EQUIPMENT**

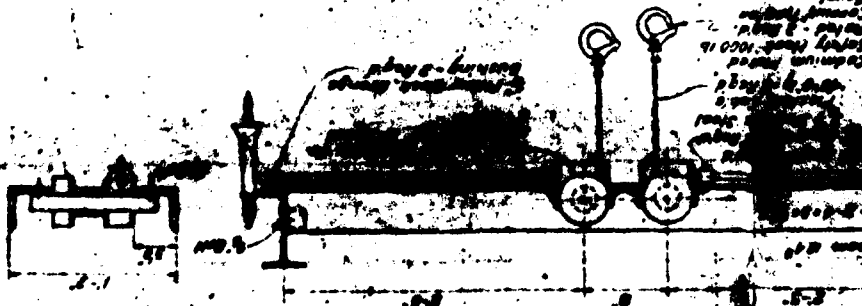
NOTE: FOR GENERAL NOTES SEE SHEET 94

SECTION 2-2



END VIEW

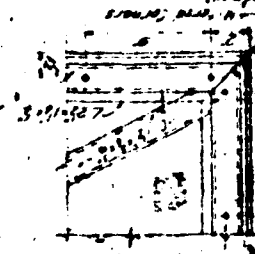
SCREEN LIFTING WINCH DETAIL



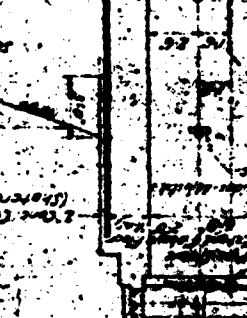
**ELEVATION OF
FILTER SCREEN**



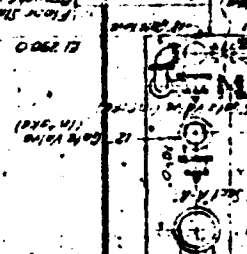
DETAIL X



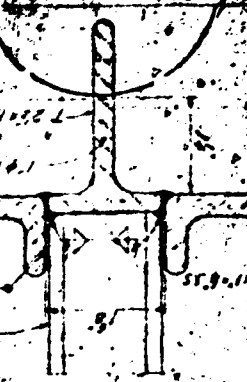
DETAIL Y

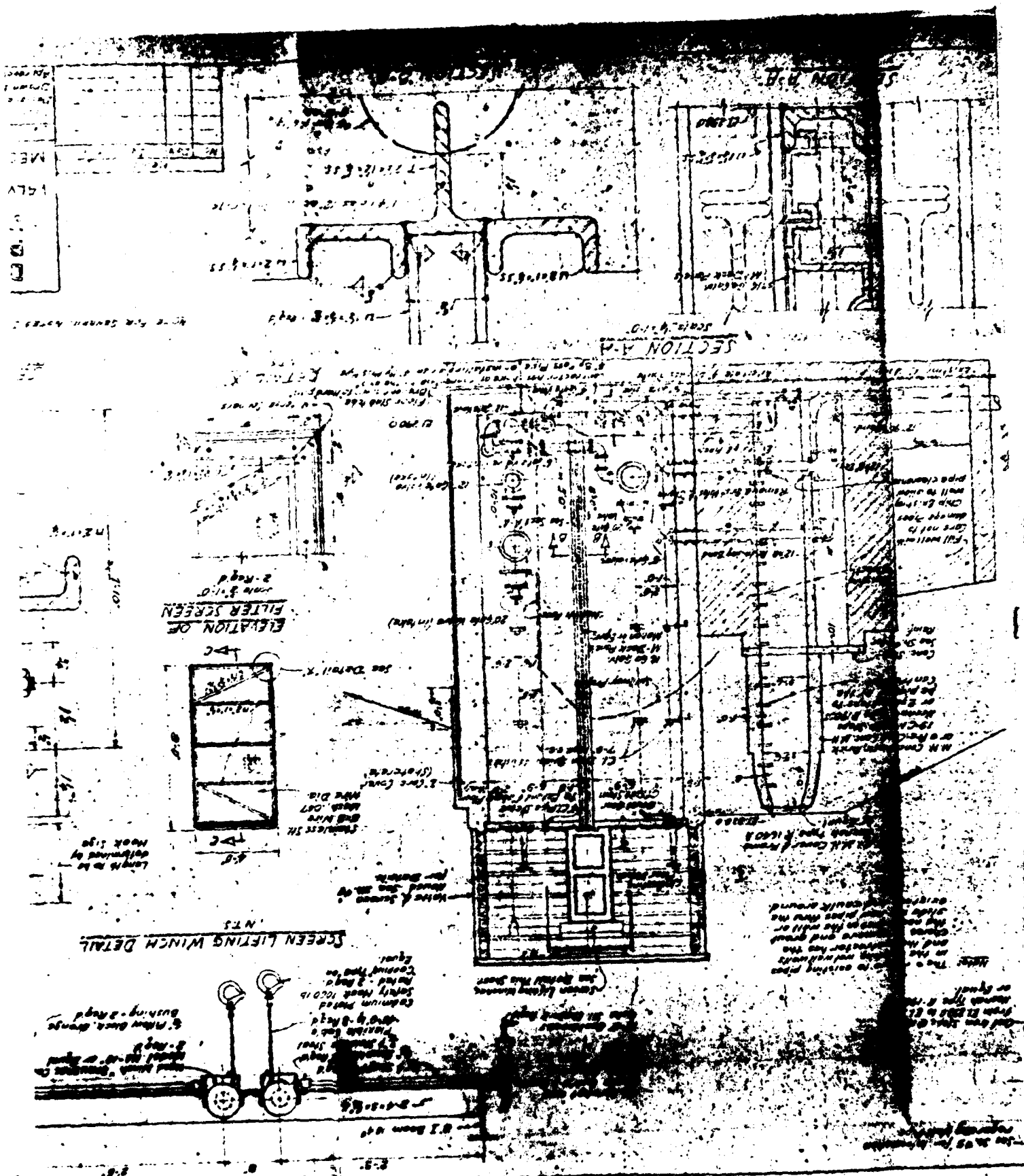


DETAIL Z



SECTION 1-1





NET WELL PLAN

Scale 1/4" = 1'-0"

Existing 27" Well

Existing 6" Pipe

Existing 12" Well

Existing 6" Pipe

Existing 6" Pipe

Existing 6" Pipe

Existing 6" Pipe

Existing 6" Pipe

Existing 6" Pipe

Existing 6" Pipe

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Existing 6" Pipe

Existing 6" Pipe

Existing 6" Pipe

Existing 6" Pipe

Existing 6" Pipe

Existing 6" Pipe

Existing 6" Pipe

See 24.95 for information regarding well plan

Cast Iron Spots @ 12" from El 2500 to El 2505

or equal

Note: There is no existing pipe in the existing well walls and the contractor has the choice to remove and grout the old pipe in the well or slide the new pipe into the old pipe and caulk around it.

El 2500

El 2505

El 2510

El 2515

El 2520

El 2525

El 2530

El 2535

El 2540

El 2545

El 2550

El 2555

El 2560

El 2565

El 2570

El 2575

El 2580

El 2585

El 2590

El 2595

El 2600

El 2605

El 2610

El 2615

El 2620

El 2625

El 2630

El 2635

El 2640

El 2645

El 2650

El 2655

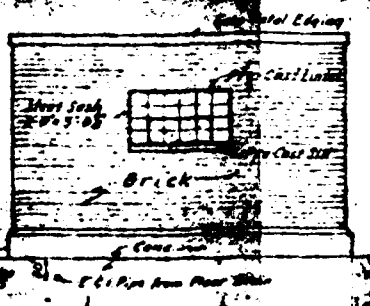
El 2660

El 2665

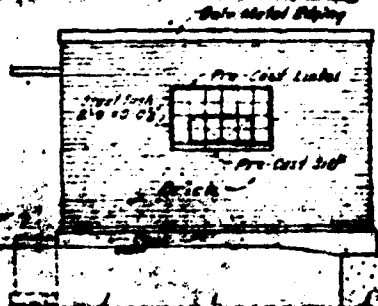
El 2670

El 2675

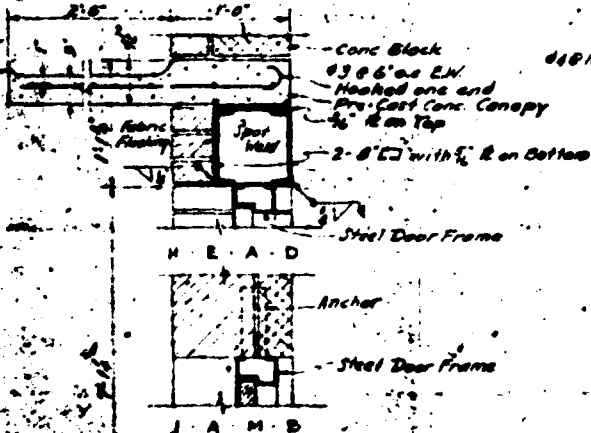
El 2680



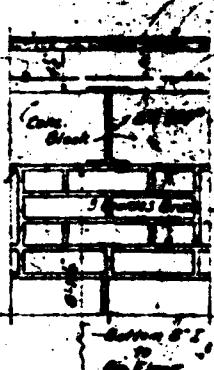
EAST ELEVATION
4'-10"



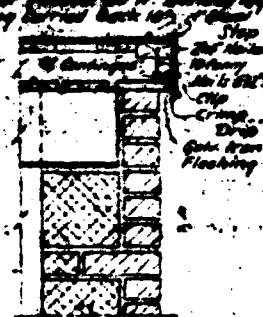
SOUTH ELEVATION
6'-10"



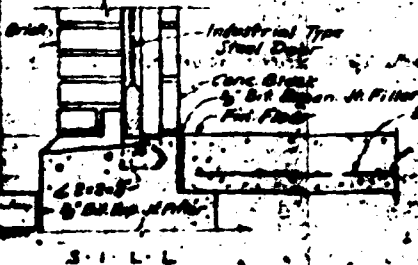
DOOR DETAIL
15'-10"



L BEAM SEAT
15'-10"



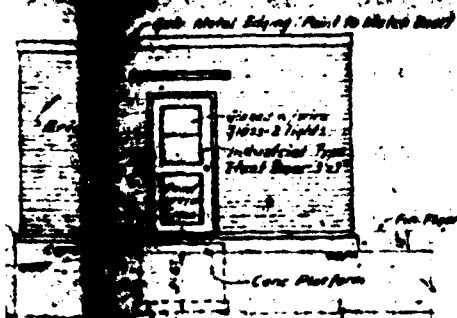
EAVE DETAIL
15'-10"



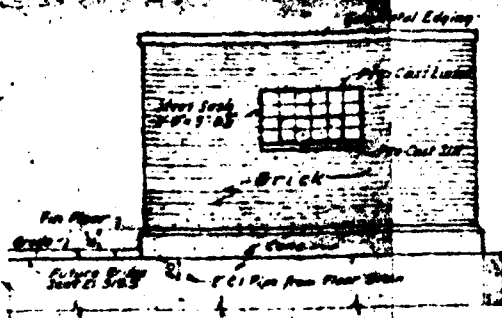
Notes: See General Notes and 2nd Fl.

**DAM FOR THE
PORTLAND, CT.
WATER WORKS
VALVE & SCREEN HOUSE
SUPERSTRUCTURE**

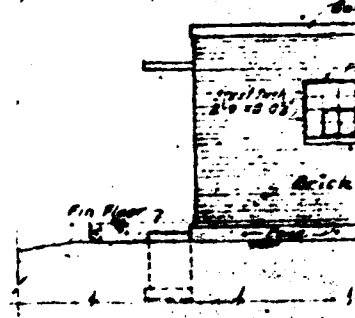
NO. 1	NO. 2	NO. 3	NO. 4	NO. 5	NO. 6	NO. 7	NO. 8	NO. 9	NO. 10	NO. 11	NO. 12	NO. 13	NO. 14	NO. 15	NO. 16	NO. 17	NO. 18	NO. 19	NO. 20	NO. 21	NO. 22	NO. 23	NO. 24	NO. 25	NO. 26	NO. 27	NO. 28	NO. 29	NO. 30	NO. 31	NO. 32	NO. 33	NO. 34	NO. 35	NO. 36	NO. 37	NO. 38	NO. 39	NO. 40	NO. 41	NO. 42	NO. 43	NO. 44	NO. 45	NO. 46	NO. 47	NO. 48	NO. 49	NO. 50	NO. 51	NO. 52	NO. 53	NO. 54	NO. 55	NO. 56	NO. 57	NO. 58	NO. 59	NO. 60	NO. 61	NO. 62	NO. 63	NO. 64	NO. 65	NO. 66	NO. 67	NO. 68	NO. 69	NO. 70	NO. 71	NO. 72	NO. 73	NO. 74	NO. 75	NO. 76	NO. 77	NO. 78	NO. 79	NO. 80	NO. 81	NO. 82	NO. 83	NO. 84	NO. 85	NO. 86	NO. 87	NO. 88	NO. 89	NO. 90	NO. 91	NO. 92	NO. 93	NO. 94	NO. 95	NO. 96	NO. 97	NO. 98	NO. 99	NO. 100
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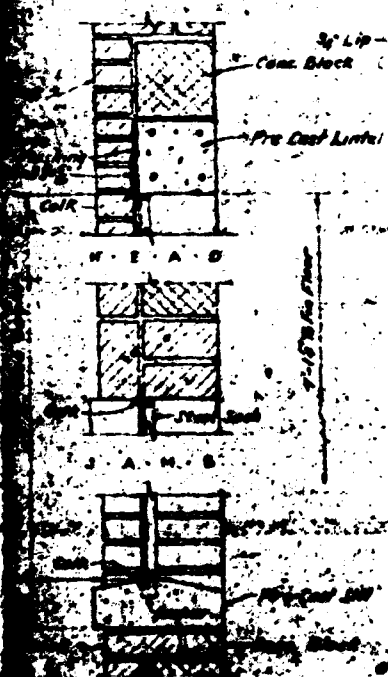
WEST ELEVATION
4'-0" x 7'-6"



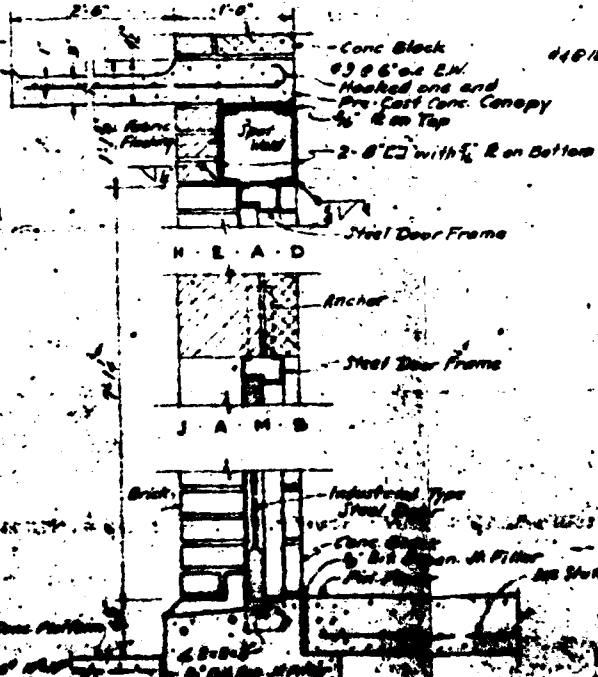
EAST ELEVATION
4'-0" x 7'-6"



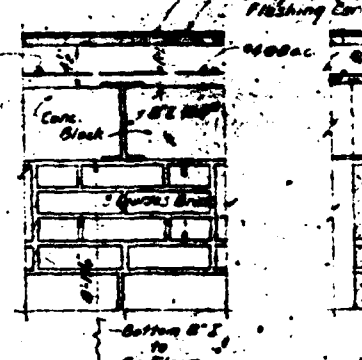
SOUTH EL
4'-0" x 7'-6"



WINDOW DETAIL
1'-0" x 7'-6"



DOOR DETAIL
1'-0" x 7'-6"



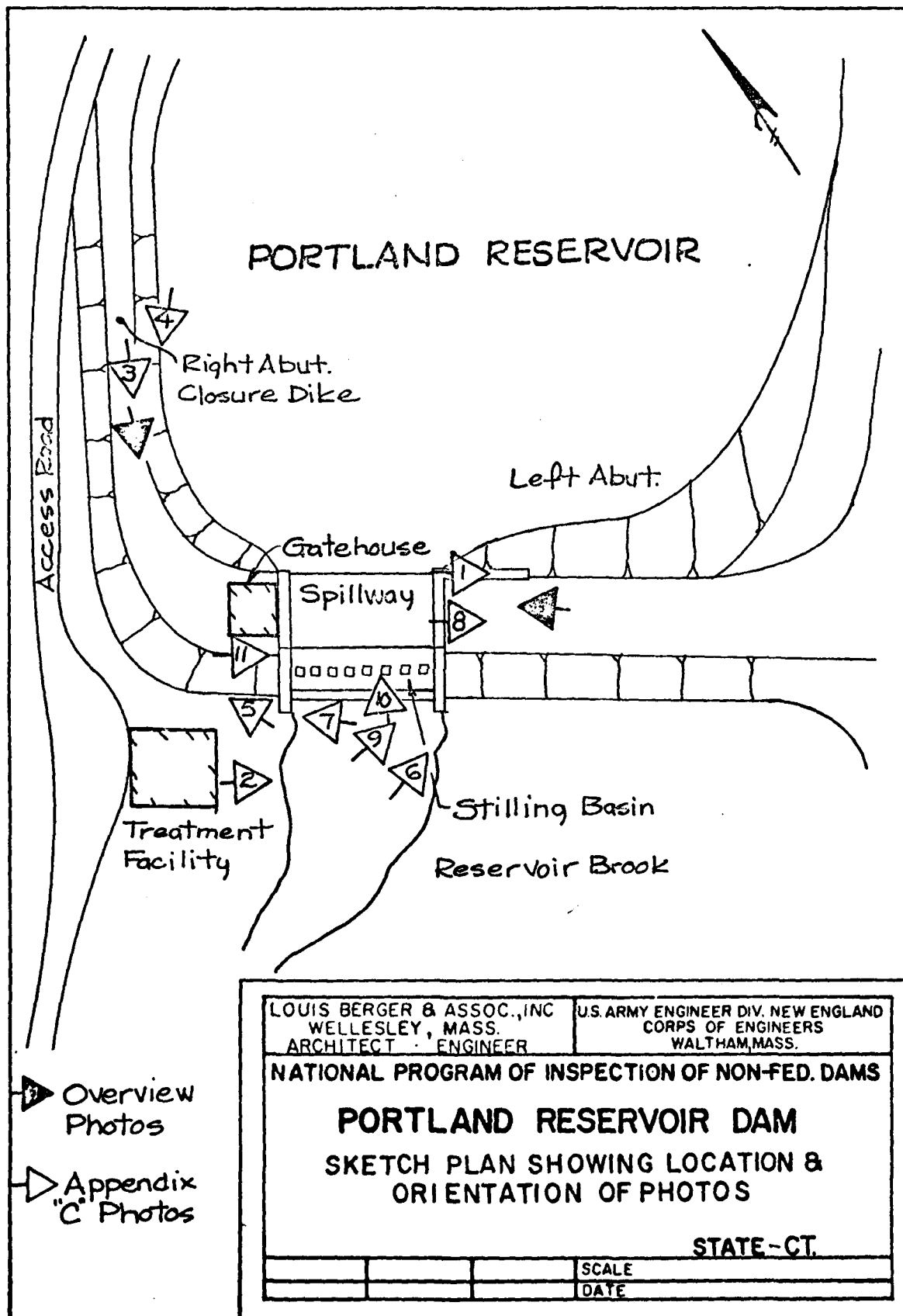
BEAM SEAT
1'-0" x 7'-6"

Notes: For Q&A

DAM & PORT WATER VALVE & SUPER

No.	Rev.	Description
1	1	Issue for Q&A
2	1	Issue for Q&A
3	1	Issue for Q&A
4	1	Issue for Q&A
5	1	Issue for Q&A
6	1	Issue for Q&A
7	1	Issue for Q&A
8	1	Issue for Q&A
9	1	Issue for Q&A
10	1	Issue for Q&A

APPENDIX C
PHOTOGRAPHS



PORTLAND RESERVOIR DAM



1. Upstream slope of Dam

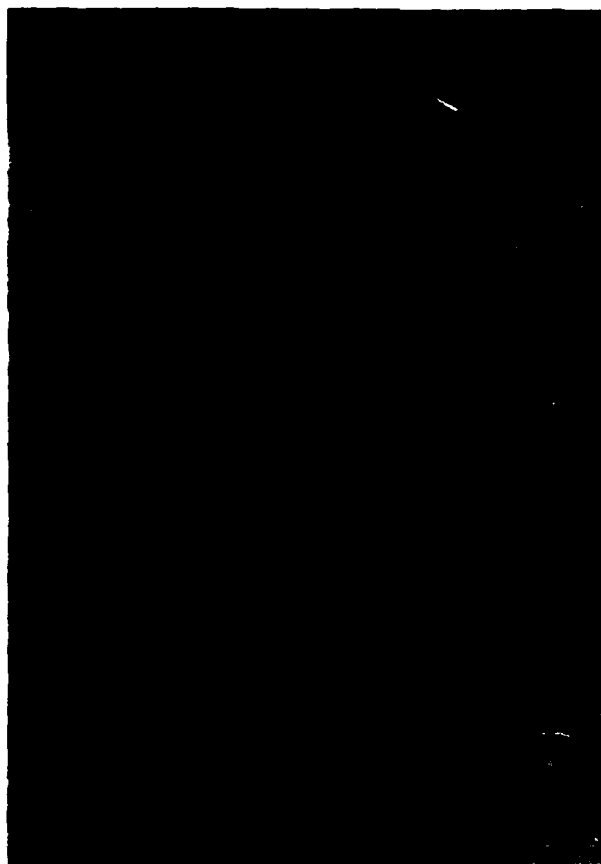


2. Downstream slope of Dam

PORTLAND RESERVOIR DAM



3. Upstream slope of Dike



4. Upstream slope of dike showing
displaced riprap, erosion and brush growth.

PORTLAND RESERVOIR DAM



5. Downstream slope of Dike

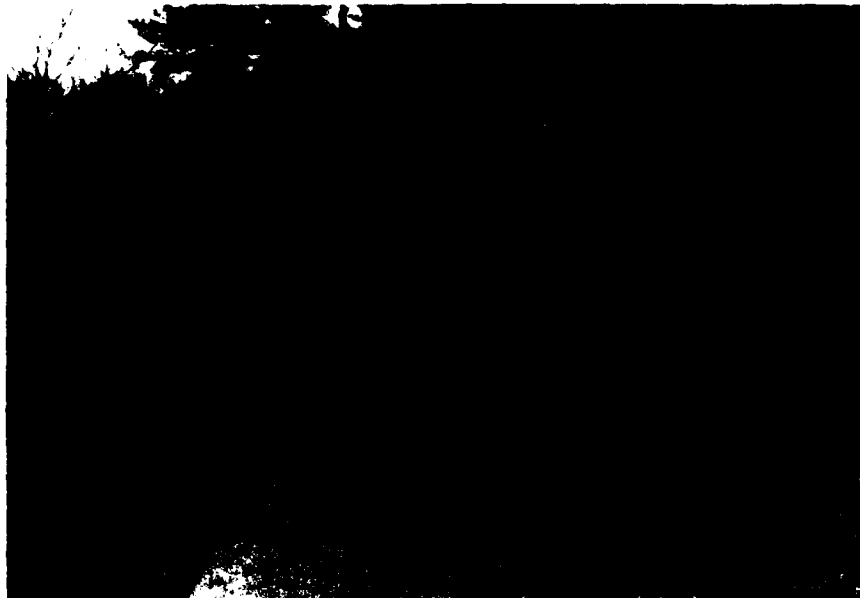


6. Dislodged riprap, covering toe drain at end of left downstream wingwall.

PORTLAND RESERVOIR DAM



7. Irregular riprap and surface water drain at end of right downstream wingwall.



8. Crest of left embankment section.

PORTLAND RESERVOIR DAM

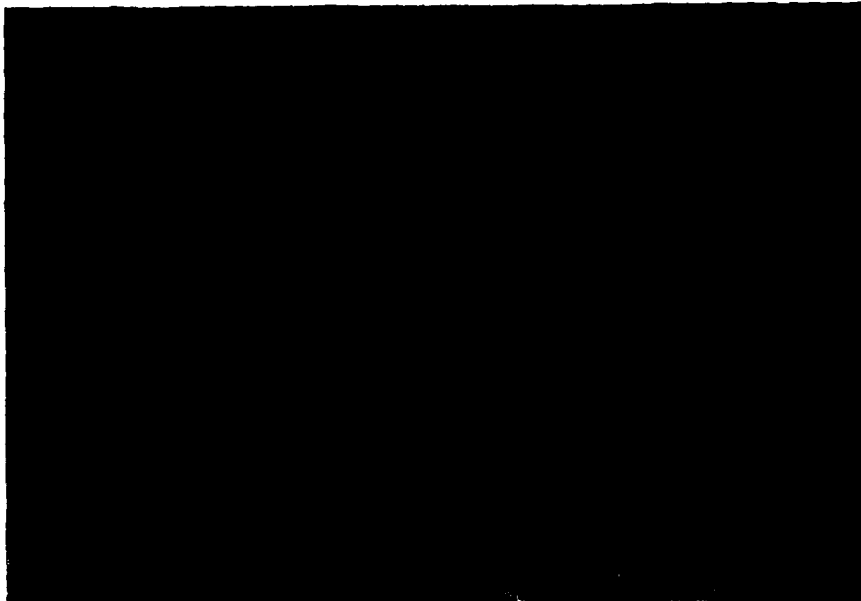


9. Seeping left wingwall joint.

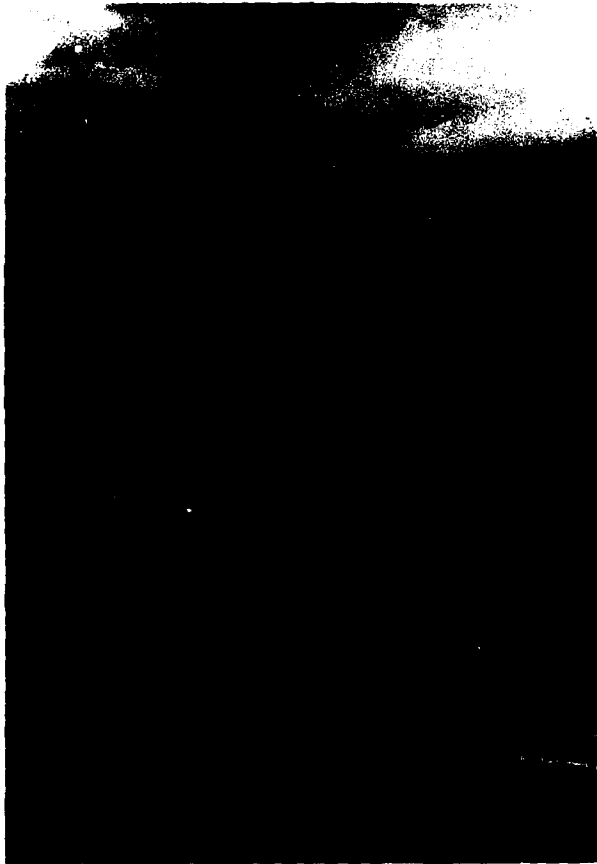


10. Spalled left panel joint.

PORTLAND RESERVOIR DAM



11. Spillway crest, showing notch and spalled panel joint.



12. Gate house, spillway and stilling basin.

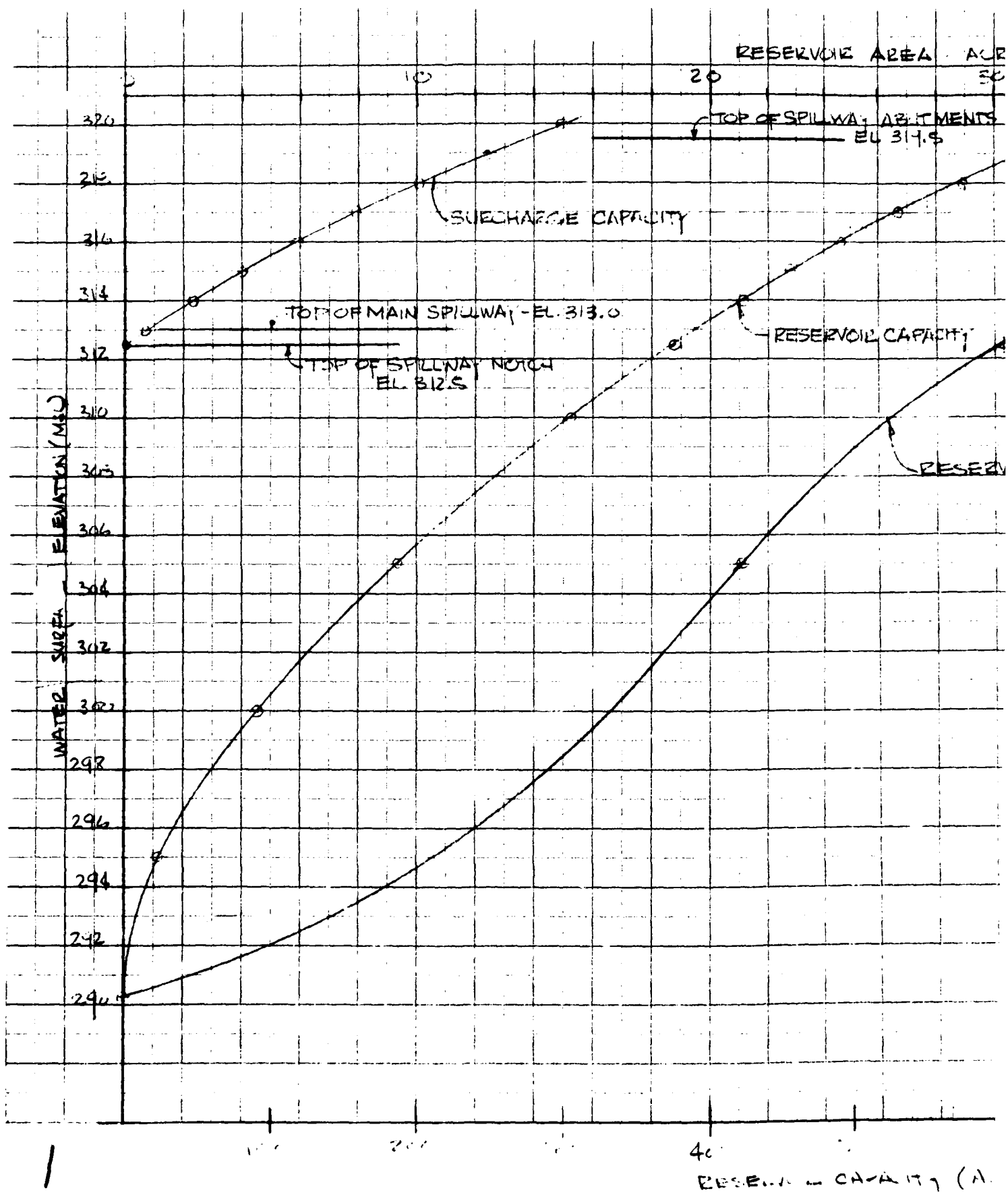
APPENDIX D
HYDROLOGIC AND HYDRAULIC COMPUTATIONS

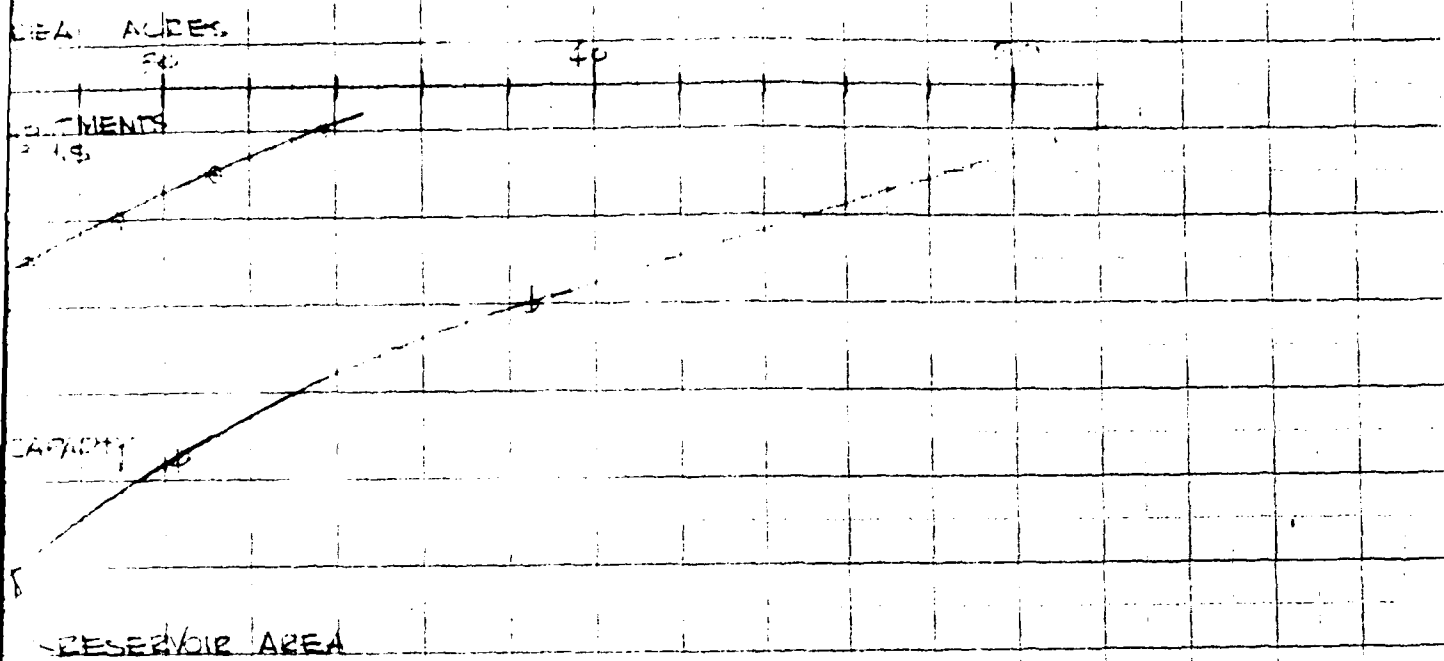
BY LLH DATE 5.3.79 LOUIS BERGER & ASSOCIATES INC. SHEET NO. 1 OF 1
 CHKD. BY _____ DATE _____ INSPECTION OF DAMS PROJECT _____
 SUBJECT PORTLAND RESERVOIR

CAPACITY ANALYSIS

ELEV MSL	AREA AC	W. AREA AC	HT. FT.	INCR. STOR AC-FT	CUM. STOR AC-FT	SURCHARGE AC-FT	REMARKS
290.3	0 *						INV. 16' INT.
295	10.6	5.3	4.7	24.9	24.9		
300	16.6	15.6	5	68.0	92.9		
305	21.1 *	18.8	5	94.0	186.9		
310	26.4	23.7	5	118.5	305.4		
312.5	30.3 *	28.3	2.5	70.7	376.1	0	(NOTCH) SPILLWAY
313.0	31.0	30.6	0.5	15.3	391.4	15.3	MAIN SPILLWAY
314.0	32.9	31.9	1	31.9	423.3	47.2	
315.0	35.2	34.0	1	34.0	457.3	81.2	
316.0	38.5 *	36.8	1	36.8	494.1	119.0	
317.0	41.8	40.1	1	40.1	534.2	158.1	
318.0	45.2	43.5	1	43.5	577.7	201.6	
319.0	48.5	46.8	1	46.8	624.5	248.4	
320.0	52.0	50.2	1	50.2	674.7	298.6	

* AREA MEASURED BY PLANIMETER FROM PLANS
 USGS MAP. ALL OTHER POINTS TAKEN OFF
 DEVELOPED CURVE.





RESERVOIR AREA & CAPACITY
CUEVES

PORTLAND RESERVOIR

FIG. 1

D-2

2

100 (A F)

1000

BY: DATE 5.2.79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 1 OF

CHKD. BY: DATE

INSPECTION OF DAMS

PROJECT

SUBJECT

DRAINAGE AREA - KATLAND RESERVOIR

GRID SHEET

AREA CALC

MIDDLE HADDAM -

$$14.80^{\text{m}} \quad \frac{29.64^{\text{m}}}{2} = 14.82^{\text{m}}$$

$$\frac{14.82^{\text{m}} \times 4,000,000 \text{ SF/SI.}}{43,560} = 1360.9 \text{ AC}$$

GLASTONBURY -

$$9.69^{\text{m}} \quad \frac{19.48^{\text{m}}}{2} = 9.74^{\text{m}}$$

$$\frac{9.74^{\text{m}} \times 4,000,000 \text{ SF/SI.}}{43,560} = 894.4 \text{ AC}$$

2255.3 AC

DRAINAGE AREA = 2255.3 AC = 3.52 SQ. MI.

BY LB DATE 5.2.79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 2 OF

CHKD. BY DATE

DESIGN OF DAMS

PROJECT

SUBJECT

PERMANENT RESERVOIR - HYDROLOGY

DRAINAGE AREA = 2255.3 AC = 3.52 SQ. MI.

RESERVOIR AREA = 0.34^{MI} $\frac{0.66^{MIMI}$
43,560
= 30.3 AC = 1.3% of D.A.

CAPACITY AT NORMAL STORAGE: 486 AC-FT (ACOE INVENTORY)
150 MG (= 459 AC-FT) TOWN

SPILLWAY CREST ELEVATION 313.0
(312.5 CTR NOTCH)

RESERVOIR LENGTH = 2200' ±
" WIDTH = 600' ±

TRIBUTARIES TO DRAINAGE AREA

<u>L</u>	<u>ΔH</u>	<u>S</u>
13,500	714-313= 401	0.030
14,000	730-313= 417	0.030
11,800	897-313= 584	0.049
11,600	780-313= 467	0.040
11,000	916-313= 603	0.055
14,000	890-313= 577	0.041
<u>75,900</u>		<u>0.245</u>
12,650 = L _{AV} = 2.40 MI.		S _{AV} = 0.041 = 215.6 FT/MI.

LAG TIME FOR UNIT HYDROGRAPH

$LAG = K \left(\frac{L L_{CA}}{\sqrt{S}} \right)^{0.33}$
 $= 3.75 \left(\frac{2.4(1.2)}{\sqrt{215.6}} \right)^{0.33}$

$= 3.75 (0.196)^{0.33} = 2.19$ SAY 2.2 HRS

$L_{CA} = \frac{L_{AV}}{2} = \frac{2.4 \text{ MI.}}{2} = 1.2 \text{ MI.}$

$S = 215.6 \text{ FT/MI.}$

$K = 3.75$

CURVE B
 (MIXED)
 COVER

BY ALM DATE 5.3.79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 3 OF

CHKD. BY DATE

INSPECTION OF DAMS

PROJECT

SUBJECT

PORTLAND RESERVOIR - HYDROLOGY

CHECK VELOCITY:

$$V = \frac{12,650'}{3600 \times 2.2 \text{ HRS}} = 1.6 \text{ FPS} \quad \text{OK} \checkmark$$

PG. 70 DSD - FOR $S = .03 \text{ to } .04$ - $V_{AV} = 3 \text{ FPS}$ NAVDOCKS
 " $S = .04 \text{ to } .07$ $V_{AV} = 2 \text{ FPS}$ TEXAS

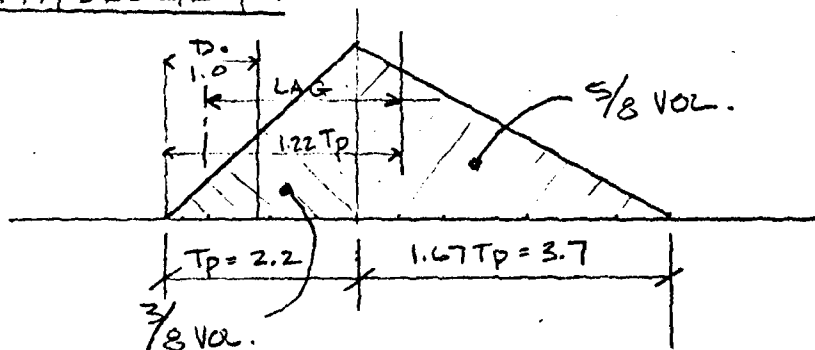
∴ $V_{AV} = 1.6 \text{ FPS}$ FOR $S_{AV} = .041$ IS O.K. ✓

CALC. T_p (TIME TO PEAK)

$$\begin{aligned} T_p &= \frac{\text{LAG}}{1.22} + \frac{D}{2(1.22)} = 0.82 \text{LAG} + 0.42 D \\ &= 0.82(2.2) + 0.42(1) \\ &= 1.804 + 0.42 = 2.22 \text{ SAY } 2.2 \text{ HRS} \end{aligned}$$

$D = 1.0$ (SET)
 PG 69 DSD
 (MODIFIED)

UNIT HYDROGRAPH



Q_p Q TO PEAK

$$Q_{Pi} = \frac{484 A Q}{T_p}$$

$A = 3.52 \text{ SQ. MI.}$
 $Q = 1" \text{ (UNT)}$
 $T_p = 2.2 \text{ HRS}$

$$= \frac{484(3.52)(1)}{2.2} = 774.4 \text{ CFS}$$

RAINFALL 24" RAINFALL IN 6 HRS (ACOE SET)

$$\text{PMF} = 0.8(24") - 0.4 = 18.8 \text{ IN}$$

D-S

FIT FACTOR = 0.8
 INFIL. = 0.4

BY Plm DATE 5.3.19

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 4 OF

CHKD. BY _____ DATE _____

INSPECTION OF DAM

PROJECT _____

SUBJECT _____

PORTLAND RESERVOIR


FLOOD HYDROGRAPH FOR PMF - INFLOW

$Q_p(10) = 774 \text{ CFS}$

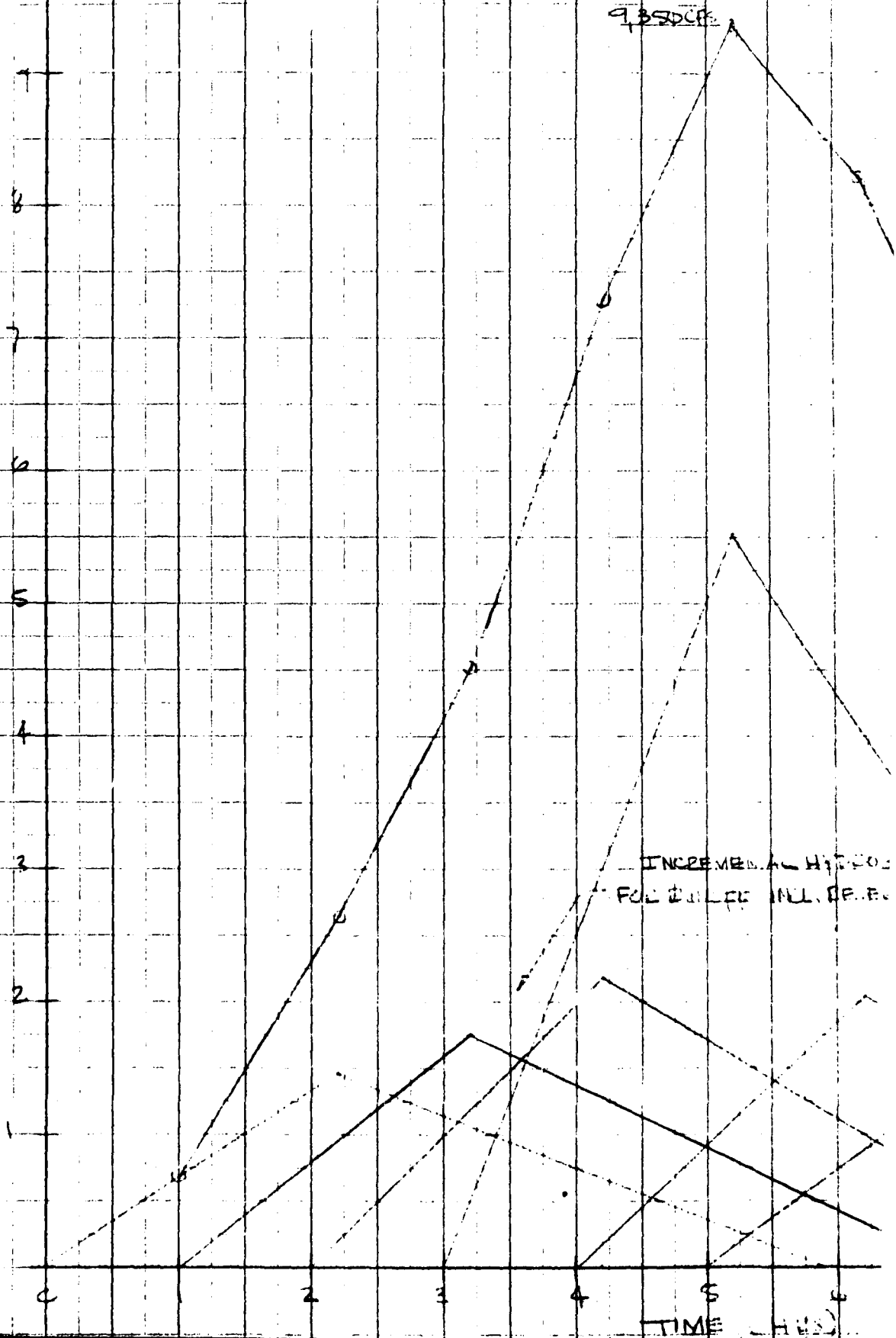
TIME HR	RAINFALL %*	IN	Qp CFS	BEGIN HR	PEAK HR	END HR	
0							
1	10	1.88	1455	0	2.2	5.9	
2	12	2.26	1749	1	3.2	6.9	
3	15	2.82	2183	2	4.2	7.9	
4	38	7.14	5526	3	5.2	8.9	
5	14	2.63	2036	4	6.2	9.9	
6	11	2.07	1602	5	7.2	10.9	

* DISTRIB. OF MAX. 6 HRS SPS OF PMP IN %

- EM 1110-2-1411
(ACOE)

 STANDARD @ CROSS SECTION
 10 X 10 TO THE HALF INCH

INFLON (CES x 1000)



INFLOW FLOOD HYDROGRAPH

PORTLAND RESERVOIR

FULL P.M.F.

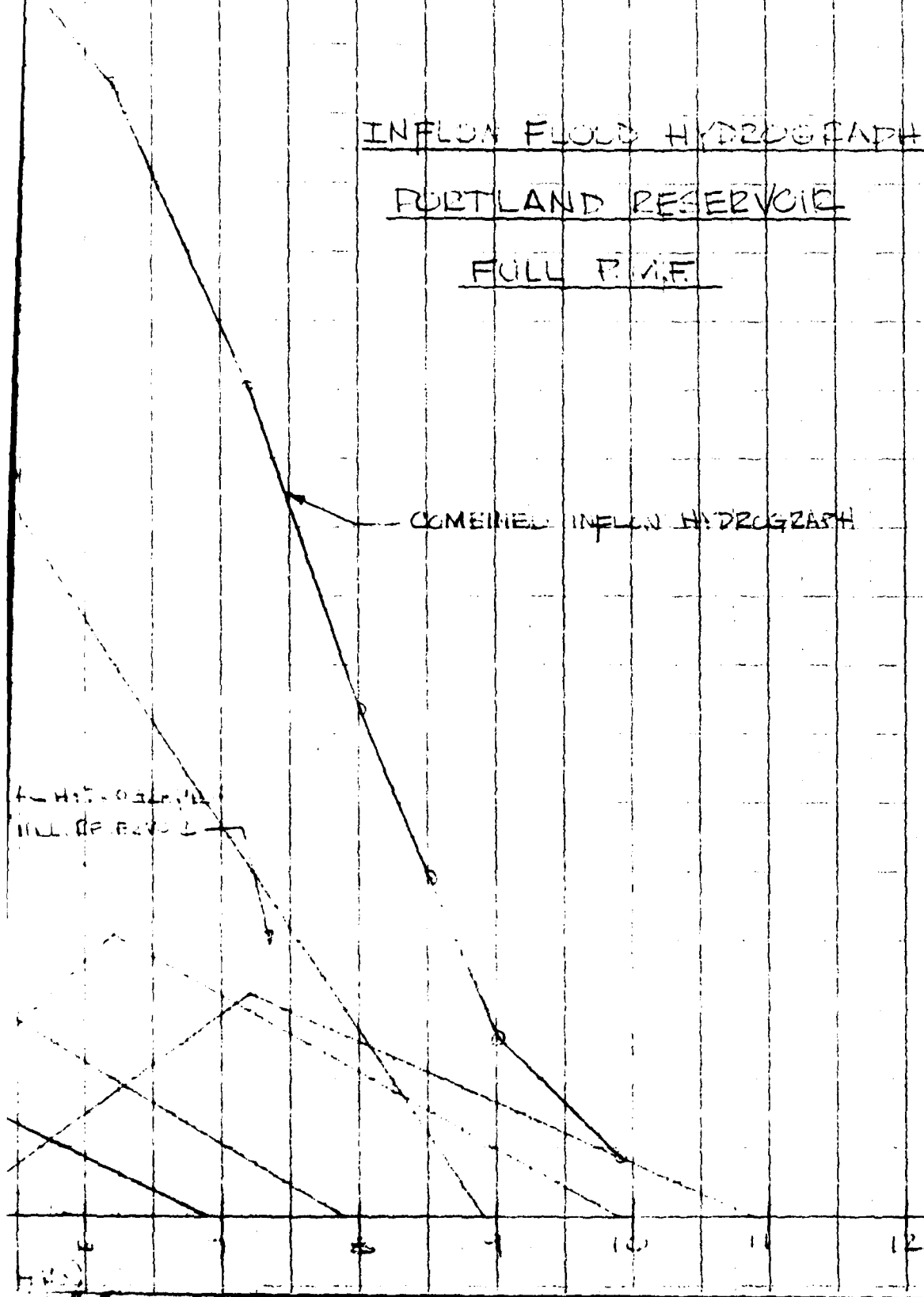


FIG. 2

BY PLM DATE 5.3.79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 1 OF 1

CHKD. BY _____ DATE _____

INSPECTION OF DAMS

PROJECT _____

SUBJECT _____

DISCHARGE ANALYSIS - PORTLAND RESERVOIR

OGEE WIER

GIVEN: $x = 10'-0"$
 $y = 5'-2"$

$$P_0 (\text{VARIES}) P_0 (\text{AV.}) = \frac{2.5 + 8}{2} = 14.5'$$

ASSUME $H_0 = 3'$, $C = 4$

$$q = CH_0^{3/2} = 4(3)^{3/2} = 20.8 \text{ CFS}$$

$$\text{Approach } V = \frac{20.8}{P_0 + H_0} = \frac{20.8}{14.5 + 3} = 1.2 \text{ FPS}$$

$$h_a = \frac{V^2}{2g} = \frac{(1.2)^2}{64.4} = 0.022$$

$$\frac{h_a}{H_0} = \frac{0.022}{3} = 0.007$$

FROM FIG 2.47 DSD - $n = 1.775$ $K = 0.54$ 45° SLOPE

$$\frac{Y}{H_0} = K \left(\frac{X}{H_0} \right)^n$$

$$\frac{5.16}{H_0} = 0.54 \left(\frac{10'}{H_0} \right)^{1.775}$$

$$\frac{5.16}{0.54} = H_0 \left(\frac{10}{H_0} \right)^{1.775}$$

$$9.55 = H_0 \left(\frac{10^{1.775}}{H_0^{1.775}} \right)$$

$$9.55 = \frac{10^{1.775}}{H_0^{0.775}}$$

$$H_0^{0.775} = \frac{10^{1.775}}{9.55} = \frac{59.6}{9.55} = 6.24'$$

$$H_0 = 10.7' \quad (\text{REVERSE CALC})$$

BY RCM DATE 5.3.79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 2 OF

CHKD. BY DATE

INSPECTION OF DAMS

PROJECT

SUBJECT

DISCHARGE ANALYSIS - PORTLAND RES.

GIVEN $X = 10'$
 $Y = 5'-2"$
 $P_0 W = 14.5$

ASSUME $H_0 = 319.5 - 313 = 6.5'$
 $C = 4$

$$q = C H_0^{3/2} = 4 (16.6) = 66.3$$

$$V = \frac{66.3}{14.5 + 6.5} = \frac{66.3}{21} = 3.15 \text{ FPS}$$

$$h_a = \frac{V^2}{2g} = \frac{3.15^2}{64.4} = 0.154$$

$$\frac{h_a}{H_0} = \frac{0.154}{6.5} = .024$$

FROM FIG 247 DSD - $n = 1.77$ $K = 0.54$ 45° SLOPE

$$\frac{Y}{H_0} = K \left(\frac{X}{H_0} \right)^n$$

$$\frac{5.16}{H_0} = 0.54 \left(\frac{10}{H_0} \right)^{1.77}$$

$$\frac{5.16}{0.54} = H_0 \left(\frac{10^{1.77}}{H_0^{1.77}} \right)$$

$$9.55 = \frac{10^{1.77}}{H_0^{0.77}}$$

$$H_0^{0.77} = \frac{58.9}{9.55} = 6.16$$

$$\underline{\underline{H_0 = 10.6'}}$$

AD-A143 346

NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
PORTLAND RESERVOIR DA..(U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV JUN 79

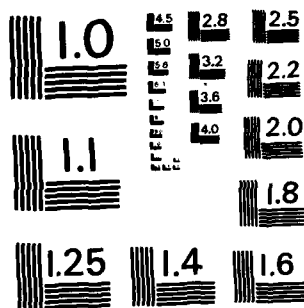
2/2

UNCLASSIFIED

F/G 13/13

NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

BY AL DATE 5.3.79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 3 OF

CHKD. BY _____ DATE _____

INSPECTION OF DAMS

PROJECT _____

SUBJECT _____

DISCHARGE ANALYSIS - PORTLAND RES.

CHECK OFFEE USING ANOTHER PT. ON CURVE

$$x = 6'$$

$$y = 1' - 10\frac{3}{4} = 1.9'$$

$$P_o (AV.) = 14.5'$$

$$\text{ASSUME } H_o = 10.5', \quad C = 4'$$

$$q = C H_o^{3/2} = 4 (10.5)^{3/2}$$

$$= 136 \text{ CFS}$$

$$h_a = \frac{v^2}{2g} = \frac{5.44^2}{64.4} = 0.46$$

$$v = \frac{136}{P_o + H_o} = \frac{136}{14.5 + 10.5} = \frac{136}{25}$$

$$\frac{h_a}{H_o} = \frac{0.46}{10.5} = .044$$

$$= 5.44 \text{ FPS}$$

FROM FIG 247 DSD - n = 1.76, k = 0.54

$$\frac{y}{H_o} = k \left(\frac{x}{H_o} \right)^n$$

$$\frac{1.9}{11.0} = 0.54 \left(\frac{6}{H_o} \right)^{1.76}$$

$$\frac{1.9}{0.54} = H_o \left(\frac{6^{1.76}}{H_o^{1.76}} \right) = \frac{23.4}{H_o^{0.76}}$$

$$3.52 = \frac{23.4}{H_o^{0.76}} \quad H_o^{0.76} = \frac{23.4}{3.52} = 6.64$$

$$H_o = 12'$$

$$\boxed{\text{USE } H_o = 11.0'}$$

$$\frac{P_o}{H_o} = \frac{14.5}{11} = 1.32 \quad \text{FIG 249 - } C_o = 3.92$$

FIG. 251 - FOR 3:3 SLOPE - REDUCE $0.994 \times 3.92 = 3.90$

$$\boxed{H_o = 11.0' \quad C_o = 3.90}$$

BY: AL DATE: 5.4.79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 4 OF

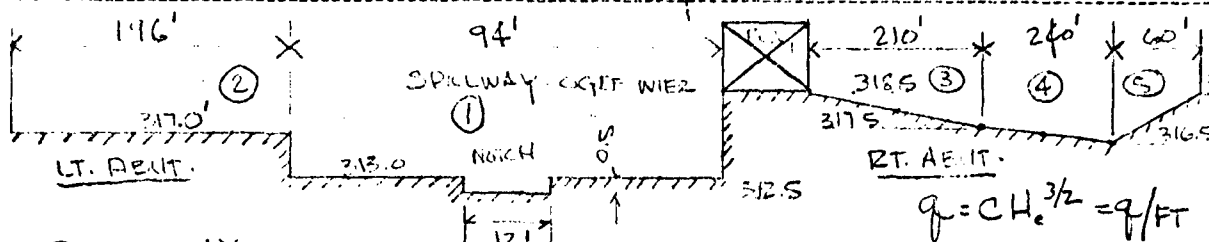
CHKD. BY: _____ DATE: _____

PORT AND RESERVOIR

PROJECT

SUBJECT

DISCHARGE ANALYSIS



① SPILLWAY $H_0 = 11.0' / C_0 = 3.90$

ELEV.	H_e	H_e/H_0	C/C	C	q/ft	$L=94'$ ΔQ	ΣQ	REMARKS
312.5	0							
313.0	0.5		$L=12'$	2.8	1.0	12	12	NOTCH SPILLWAY CREST
314	1.0	0.09	.82	3.20	3.20	301	313	
315	2.0	0.18	.85	3.31	9.36	880	892	
316	3.0	0.27	.88	3.43	17.82	1675	1687	
317	4.0	.36	.89	3.47	27.76	2609	2621	
317.5	4.5	.41	.90	3.51	33.50	3149	3161	
318	5.0	.45	.91	3.55	39.69	3730	3742	
318.5	5.5	.50	.92	3.59	46.31	4353	4365	
319	6.0	.54	.93	3.63	53.35	5015	5027	
320	7.0	.64	.95	3.71	68.71	6459	6471	
321	8.0	.73	.96	3.74	84.65	7955	7967	
322	9.0	.82	.98	3.82	103.14	9695	9707	
② LT. ABUTMENT $L=196'$								
ELEV.	H_e			C	q/ft	ΔQ		
317	0					0		
317.5	0.5			2.8	1.0	196		
318.0	1.0			"	2.8	549		
318.5	1.5			"	5.1	1008		
319	2.0			"	7.9	1552		
320	3.0			"	14.5	2852		
321	4.0			"	22.4	4390		
322	5.0			"	31.3	6136		

BY: LL DATE: 5.4.79 LOUIS BERGER & ASSOCIATES INC. SHEET NO. 5 OF 5
 CHKD. BY: _____ DATE: _____ PROJECT: _____
 SUBJECT: PORTLAND RESERVOIR - DUCK LAKE ANALYSIS

LT ABUTMENT (3), (4) & (5)

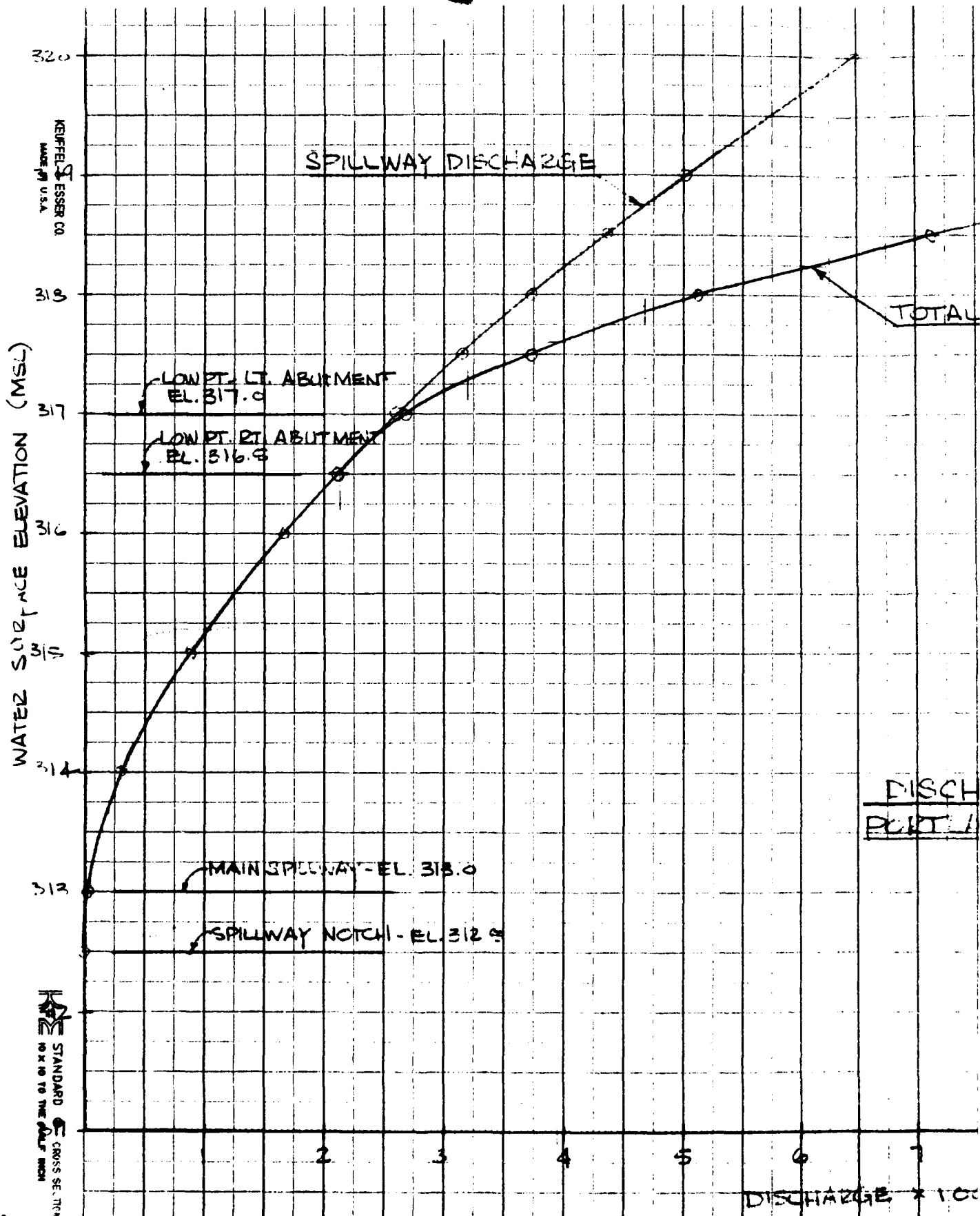
$$q = CH^{\frac{3}{2}} \text{ FOR } \square; \frac{1}{2} \text{ FOR } \square$$

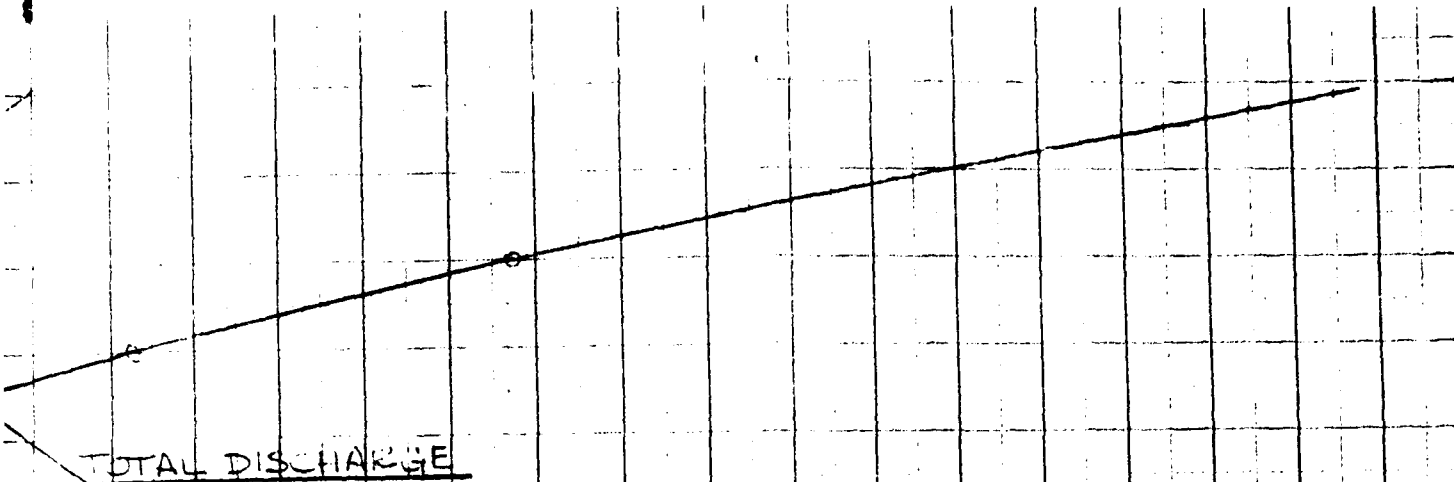
ELEV	(3) L=210'				(4) L=240'				(5) L=60'			
	H ₀	C	q/ft	ΔQ ₃	H ₀	C	q/ft	ΔQ ₄	H ₀	C	q/ft	ΔQ ₅
316.5					0	—	—	—	0	—	—	—
317.0					0.5	2.8	$\frac{L=120}{0.5}$	59	0.5	2.8	$\frac{L=15}{0.5}$	7
317.5	0	—	—	—	1.0	2.8	$\frac{L=210}{1.4}$	336	1.0	"	$\frac{L=30}{1.4}$	42
Av. 318.0	0.5	2.8	$\frac{L=105}{0.5}$	52	$\frac{H_{AV.}}{1.6}$	"	2.8	672	1.5	"	$\frac{L=45}{2.6}$	117
318.5	1.0	"	$\frac{L=210}{1.4}$	294	1.5	"	5.1	1224	2.0	"	$\frac{L=60}{4.0}$	240
319.0	$\frac{H_{AV.}}{1.0}$	2.8	2.8	588	2.0	"	7.9	1896	$\frac{H_{AV.}}{1.5}$	"	5.1	306
320.0	2.0	"	7.9	1663	3.0	"	14.5	3480	2.5	"	11.1	666
321.0	3.0	"	14.5	3055	4.0	"	22.4	5376	3.5	"	18.3	1098
322.0	4.0	"	22.4	4704	5.0	"	31.3	7512	4.5	"	26.7	1602

SUMMARY

ELEV	SPURWAY LT. ABT.			RT. ABT.			Σ Q CFS
	ΔQ ₃	ΔQ ₄	ΔQ ₅	ΔQ ₃	ΔQ ₄	ΔQ ₅	
312.5	0						0
313.0	12						12
314.0	313						313
315.0	892						892
316.0	1687						1687
316.5					0	0	
317.0	2621	0		59	7		2687
317.5	3161	196	0	336	42		3735
318.0	3742	549	52	672	117		5132
318.5	4365	1008	294	1224	240		7131
319.0	5027	1552	588	1896	306		9369
320.0	6471	2852	1663	3480	666		15132
321.0	7967	4390	3055	5376	1098		21886
322.0	9707	6136	4704	7512	1602		29661

D-12





DISCHARGE CURVE
PORTLAND RESERVOIR

FIG. 3

DISCHARGE $\times 1000$ CFS.

D-13

2

BY: LB DATE 5.7.79 LOUIS BERGER & ASSOCIATES INC. SHEET NO. 1 OF 1
 CHKD. BY: _____ DATE _____ INSPECTION OF DAMS PROJECT _____
 SUBJECT: FLOOD ROUTING - PORTLAND RESERVOIR

AD = 2255 AC. = 3.52 SQ MI.

HT. DAM = 25' ±

STORAGE = 486 AC-FT (ACOE)

459 AC-FT (TOWN)

391 AC-FT (CALCED)

BO SIZE CLASSIFICATION = SMALL

HAZARD POTENTIAL = HIGH

INSPECTION OF PMF

1. PEAK INFLOW $Q_{P1} = 9,350$ CFS - FROM INFLOW HYDROGRAPH

2. a. SURCHARGE HT. FOR $Q_{P1} = 319.0$ (FROM DISCHARGE CURVE)

b. VOLUME OF SURCHARGE ($STOR_1$) = 624 AC-FT (CAPACITY CURVE)

$$STOR_1 \text{ (IN INCHES)} = \frac{624 \text{ AC-FT} \times 12}{2255 \text{ AC}} = 3.32 \text{ INCHES}$$

$$c. Q_{P2} = Q_{P1} \left(1 - \frac{STOR_1}{19}\right) = 9350 \left(1 - \frac{3.32}{19}\right)$$

$$= 9350 - 1634 = 7716 \text{ CFS}$$

3. a. SURCHARGE HT FOR $Q_{P2} = 318.6$ FT (FROM DISCHARGE CURVE)

b. VOLUME OF SURCHARGE ($STOR_2$) = 600 AC-FT

$$STOR_2 \frac{600 \times 12}{2255} = 3.19 \text{ INCHES}$$

$$AVER. STOR = \frac{STOR_1 + STOR_2}{2} = \frac{3.32 + 3.19}{2} = 3.25 \text{ INCHES}$$

$$\frac{3.25 \text{ INCH} \times 2255}{12} = 610.7 \text{ AC-FT}$$

SURCHARGE HT (AVER) = 318.8 FT. (FROM CAPACITY CURVE)

D-14

BY PLM DATE 9.7.79 LOUIS BERGER & ASSOCIATES INC. SHEET NO. 2 OF 2
 CHKD. BY _____ DATE _____ INSPECTION OF DAMS PROJECT _____
 SUBJECT FLOOD ROUTING - PORTLAND RESERVOIR

FDR SURCHARGE HT. = 318.8 FT.

Q_{P3} (PEAK OUTFLOW) = 8,450 CFS

MAX. SPILLWAY CAN HANDLE BEFORE ABUTMENTS OVERTOPPED
 IS A EL. 316.5 - $Q_{MAX} = 2,140$ CFS

∴ SPILLWAY INADEQUATE TO HANDLE FULL PMF
 OVERTOPPED DAM BY $318.8 - 316.5 = 2.3$ FT.

CHECK 1/2 PMF

$Q_{P1} = 9350 \div 2 = \underline{4675 \text{ CFS}}$

2a. SURCHARGE HT. = 317.9 FT

b. VOL. OF SURCHARGE ($STOR_1$) = 568 AC-FT

$STOR_1$ (IN INCHES) = $\frac{568 \times 12}{2255} = 3.0$ INCHES

c. $Q_{P2} = Q_{P1} \times \left(1 - \frac{STOR_1}{9.5}\right) = 4675 \left(1 - \frac{3.0}{9.5}\right)$
 $= 4675 - 1476 = \underline{3199 \text{ CFS}}$

3a. SURCHARGE HT. = 317.3 FT

b. VOLUME OF SURCHARGE ($STOR_2$) = 544 AC-FT

$(STOR_2) = \frac{544 \times 12}{2255} = 2.9$ INCHES

AVER. $STOR = \underline{2.95 \text{ INCHES}}$

D-15

BY: PLN DATE 5.7.76 LOUIS BERGER & ASSOCIATES INC. SHEET NO. 3 OF
CHKD. BY: DATE INSPECTION OF DAMS PROJECT
SUBJECT: FLOOD ROUTING - PORTLAND RESERVOIR

$$AV. STOR = 2.95 \text{ INCHES}$$

$$\frac{2.95 \times 2255}{12} = 55.4 \text{ AC-FT}$$

$$\text{SURCHARGE HT. (AV.)} = 317.6 \text{ (FROM CAPACITY CURVE)}$$

$$\therefore Q_2 = 3,950 \text{ CFS}$$

∴ SPILLWAY INADEQUATE TO HANDLE 1/2 PMF
OVERTOP DAM BY $317.6 - 316.5 = 1.1 \text{ FT}$

BY: RL DATE 5.7.79 LOUIS BERGER & ASSOCIATES INC. SHEET NO. 1 OF 1
 CHKD. BY: _____ DATE _____ INSPECTION OF DAM PROJECT _____
 SUBJECT: FAILURE ANALYSIS - POTLAND RESERVOIR

STEP 1: RESERVOIR STORAGE AT FAILURE
 ASSUME WATER ELEV. AT TOP OF DAM. W/O
 OVERTOPPING - SAY EL. 316.5

FROM CAPACITY CURVE - STORAGE AT EL. 316.5 - 510,000

STEP 2: PEAK OUTFLOW AT FAILURE

$$Q_P = \frac{8}{27} W_b \sqrt{8} Y_0^{1.5}$$

$$Q_P = \frac{8}{27} (125') (\sqrt{32.2}) (28')^{1.5}$$

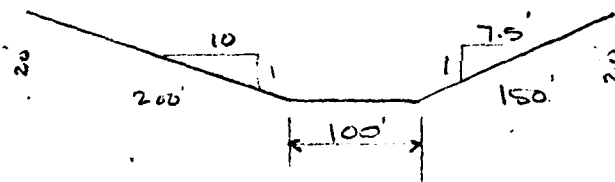
$$= 31,138 \text{ CFS SAY } \underline{31,000 \text{ CFS}}$$

$W_b = 40\% \text{ DAM WIDTH AT MID HEIGHT}$
 $= 0.40 (316) = 126$
 $= 125' \text{ DEL. 302.5}$
 $Y_0 = \text{TOTAL HT. WATER LEVEL TO BED ELEV.}$
 $= 316.5 - 288.5 = 28'$

STEP 3:

STAGE-DISCHARGE RATING CURVE FOR DOWNSTREAM REACH.

TYPICAL SECTION AT 1500' DOWNSTREAM.



USING MANNING FORMULA - $Q = VA \cdot \left(\frac{1.486}{n} R^{2/3} S^{1/2} \right) A$
 USE $n = 0.14$ (HDS #3 - PG 100).

$$S_{AV} = \frac{50}{1500} = .033$$

H	A(SF)	P(L)	$R^{2/3}$	$\frac{1.486}{n}$	$S^{1/2}$	Q CFS
5	719	188	2.45	10.61	0.182	3402
10	1875	276	3.59	"	"	12,998
15	3469	364	4.50	"	"	30,142
20	5500	452	5.29	"	"	56,193.

D-17

BY RL DATE 5.8.79 LOUIS BERGER & ASSOCIATES INC. SHEET NO. 2 OF 2
 CHKD. BY _____ DATE _____ INSPECTION OF DAMS PROJECT _____
 SUBJECT _____ FAILURE ANALYSIS - PORTLAND RESERVOIR

STEP 4: $Q_{P1} = 31,000$ CFS FROM S-D CURVE:
 STAGE₁ = 15.2 FT

ESTIMATE Q_{P2}

STORAGE (S) = 510 AC $S/Z = 255$ AC-FT

TRY $L_{REACH1} = 1500'$

$$A_1 = \frac{15.2 \times 10 \times 15.2}{2} + 100 \times 15.2 + \frac{15.2 \times 7.5 \times 15.2}{2}$$

$$= 1155 + 1520 + 866 = 3541 \text{ S.F.}$$

$$V_1 = \frac{3541 \text{ SF} \times 1500'}{43560} = 121.9 \text{ AC-FT} \quad \text{OK.} \checkmark$$

$$\text{TRIAL } Q_{P2} = Q_{P1} \left(1 - \frac{\text{Vol}_1}{S}\right) = 31,000 \left(1 - \frac{122}{510}\right) = 23,580 \text{ CFS}$$

TRIAL STAGE₂ = 13.7'

$$A_2 = \frac{13.7 \times 10 \times 13.7}{2} + (13.7 \times 100) + \frac{13.7 \times 7.5 \times 13.7}{2}$$

$$= 938 + 1370 + 704 = 3012 \text{ SF}$$

$$V_2 = \frac{3012 \times 1500}{43560} = 103.7 \text{ AC-FT}$$

$$V_{AV} = \frac{V_1 + V_2}{2} = \frac{121.9 + 103.7}{2} = 112.8 \text{ SAY } 113 \text{ AC-FT}$$

$$Q_{P2} = Q_{P1} \left(1 - \frac{113}{510}\right) = \underline{24,131 \text{ CFS}}$$

STAGE₂ = 13.8 FT

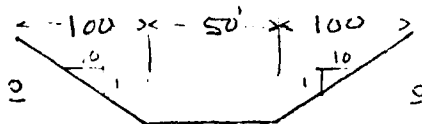
so AT 1500' D/S - $Q_P = 24,131$ CFS
 STAGE₂ = 13.8 FT

BY: DATE 5.8.79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 3 OF CHKD. BY: DATE INSPECTION OF DAMSPROJECT SUBJECT PORTLAND - FAILURE ANALYSIS

AT 2700' D/S (100' PAST ROAD CROSSING)

SECTION :

$$S_{AV} = \frac{30'}{1200} = .025$$

H	ASF	P(LF)	$D^{2/3}$	$1.486/n$		Q_{CFS}
5	500	150.5	2.23	10.61	58	1869
10	1500	251.0	3.29	"	"	8,273
15	3000	351.5	4.18	"	"	21,021
17	3740	391.7	4.50	"	"	28,213

FOR $Q_{P2} = 24,131$ CFS
 STAGE₂ = 15.8 CFS.

TRY $L_{REACH2} = 1200'$

$$A_2 = (15.8 \times 10 \times 15.8) + (15.8 \times 50) = 3286 \text{ SF}$$

$$V_2 = \frac{3286 \times 1200}{43560} = 90.5 < 255 \text{ OK}$$

$$\text{TRIAL } Q_{P2} = Q_{P2} \left(1 - \frac{V_2}{S}\right) = 24131 \left(1 - \frac{91}{510}\right) = 19,825 \text{ CFS}$$

$$\text{TRIAL STAGE}_3 = \underline{14.6 \text{ FT}}$$

$$A_3 = (14.6 \times 10 \times 14.6) + 50 \times 14.6 = 2861$$

$$V_3 = \frac{2861 \times 1200}{43,560} = 78.8 \text{ AC-FT}$$

$$V_{AV} = \frac{V_2 + V_3}{2} = \frac{90.5 + 78.8}{2} = 84.6 \text{ AC-FT}$$

$$Q_{P3} = Q_{P2} \left(1 - \frac{84.6}{510}\right) = 24,131 (.834) = 20,128 \text{ CFS}$$

$$\underline{\text{STAGE}_3 = 14.7 \text{ FT}}$$

AT 2700 D/S:
 $Q_{P3} = 20,128 \text{ CFS}$
 STAGE₃ = 14.7 FT

D-19

BY: PLC DATE: 5.8.79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 4 OF

CHKD. BY: DATE:

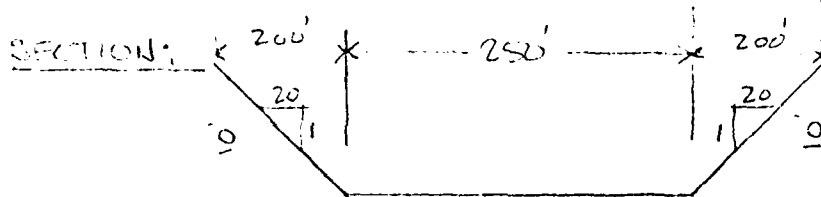
FAILURE ANALYSIS

PROJECT

SUBJECT

PORTLAND CEMENT

AT 4500' D/S (NEXT TO SMALL SUBDIVISION)



$$S_{AJ} = \frac{25}{1800} = .014$$

H	A (SF)	P (LF)	$R^{2/3}$	$1.486/n$	$S^{1/2}$	Q_{CFS}
5	1750	450.2	2.47	10.61	.118	5,412
10	4500	650.5	3.63	"	"	20,451
15	8250	850.7	4.55	"	"	46,996

FOR $Q_{P3} = 20,128 \text{ CFS}$

STAGE₃ = 10.0 FT — AREA WIDENS

TRY $L_{REACH3} = 1800'$

$$A_3 = 10 \times 20 \times 10 + (250 \times 10) = 2000 + 2500 = 4500 \text{ SF}$$

$$V_3 = \frac{4500 \times 1800}{43560} = 186 < 255 = S^{1/2} \text{ O.K.}$$

$$\text{TRIAL } Q_{P4} = Q_{P3} \left(1 - \frac{V_3}{S}\right) = 20,128 \left(1 - \frac{186}{510}\right) = 12,787 \text{ CFS}$$

TRIAL STAGE₄ = 8.2 FT

$$A_4 = (8.2 \times 20 \times 8.2) + 250 \times 8.2 = 3395 \text{ SF}$$

$$V_4 = \frac{3395 \times 1800}{43560} = 140 \text{ AC-FT}$$

$$V_{AV} = \frac{186 + 140}{2} = 163 \text{ AC-FT}$$

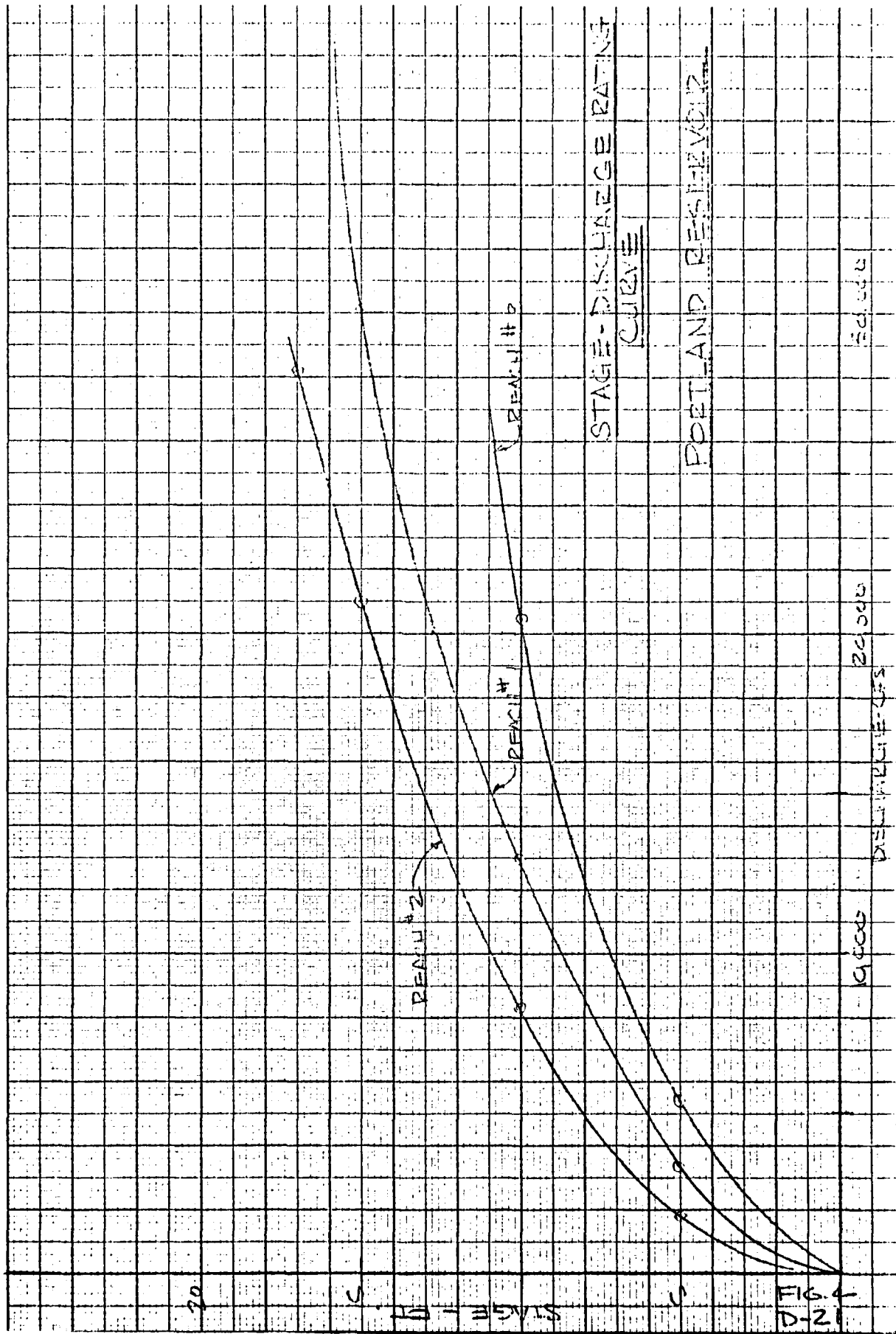
$$Q_{P4} = Q_{P3} \left(1 - \frac{V_{AV}}{S}\right) = 20,128 \left(1 - \frac{163}{510}\right) = 13,695 \text{ CFS}$$

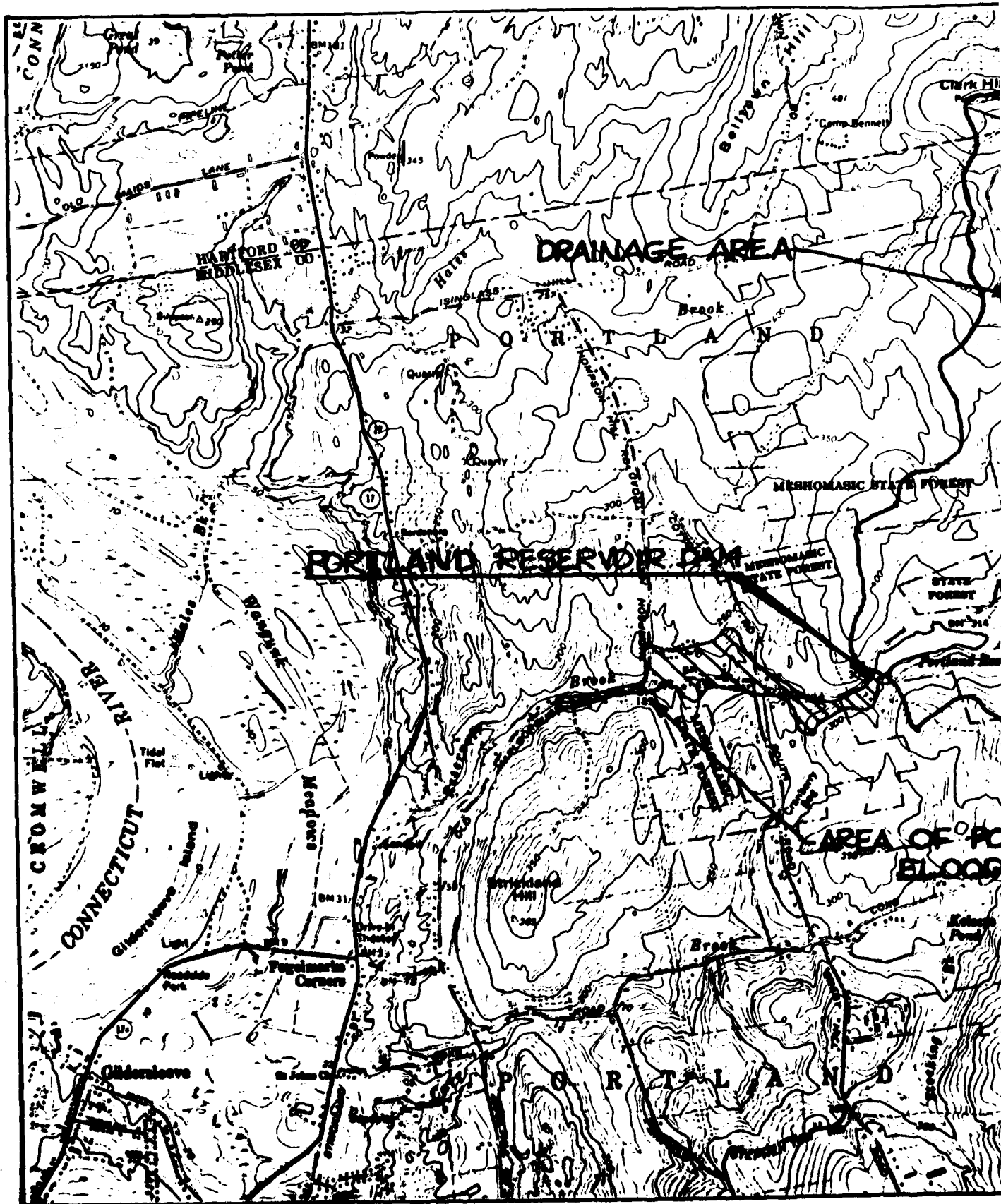
STAGE₄ = 8.4 FT

D-20

∴ AT 4500' D/S $Q_{P4} = 13,695 \text{ CFS}$
HT. = 8.4 FT

STANDARD CROSS SECTION
10 x 10 TO THE HALF INCH





APPENDIX E

INFORMATION AS CONTAINED IN
THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	COUNTY	DISTRICT	NAME	REPORT DATE				
CT	00	02	PORTLAND RESERVOIR DAM	25 JUN 79				
LATITUDE (NORTH)		LONGITUDE (WEST)		REPORT DATE				
4135.4		7259.2		25 JUN 79				
<table border="1"> <tr> <td>POPULAR NAME</td> <td>NAME OF EQUIPMENT</td> </tr> <tr> <td>PORTLAND RESERVOIR</td> <td></td> </tr> </table>					POPULAR NAME	NAME OF EQUIPMENT	PORTLAND RESERVOIR	
POPULAR NAME	NAME OF EQUIPMENT							
PORTLAND RESERVOIR								
NEAREST DOWNSTREAM CITY/TOWN/VILLAGE		POPULATION						
PORTLAND		8900						
YEAR COMPLETED	PURPOSES	DESIGN CAPACITY (CFS)	DESIGN YEAR	DESIGN FLOOD (CFS)				
1974	5	30	2	510				
REMARKS								

SPILLWAY	MAXIMUM DISCHARGE (CFS)	VOLUME OF DAM (CFS)	POWER CAPACITY (KW)	NAVIGATION LOCKS
1	500	2140	34200	

OWNER	ENGINEERING BY	CONSTRUCTION BY
CITY OF PORTLAND, CONN	ARCHIVES ENGINEERS	
DESIGN	CONSTRUCTION	OPERATION
	40-1-E	1, J, E
INSPECTION BY		MAINTENANCE
LOUIS HERGEN + ASSOCIATES, INC		CT DEP

INSPECTION DATE	AUTHORITY FOR INSPECTION
DAY MONTH YEAR	
20 APR 79	PL 42-507

REMARKS
3-1-1 INCLUDES DIME 450 FT LONG

END

DATE
FILMED

9 84

DTI